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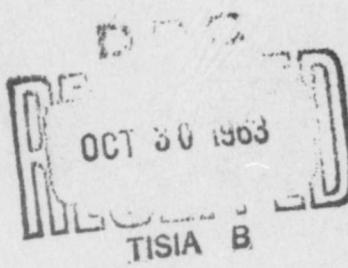
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## LEADING EDGE CONCEPTS AND ATTACHMENTS - PRELIMINARY

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PAGE 3-1

### 3.1 SUMMARY

3.1.1 A series of five leading edge concepts were subjected to three separate environment test programs. Each configuration was exposed to a sonic environment, a thermal gradient test, a second sonic exposure, and finally, a static load test. The purpose of these tests was to evaluate these five basic leading edge concepts and their various design features to obtain information for a production configuration and to verify analytical procedures.

3.1.2 The Phase A of the sonic test program (LT-5-617-1A-Reference 1) consisted of the exposure of each specimen to a random noise environment of 152.5 db SPL\* (overall) for 30 minutes.

3.1.3 The heat test program (LT-5-617-2-Reference 1) consisted of subjecting each specimen to four 2700°F. heat cycles of forty minutes duration, and one 3000°F. heat cycle of ten minutes duration. The data collected was used to determine design temperature distribution.

3.1.4 After the heat program each specimen was exposed to a sonic environment of 152.5 db SPL (overall) for 30 minutes and then to 155.5 db for an additional 30 minutes, according to Phase B of LT-5-617-1-Reference 1).

3.1.5 The load program (LT-5-617-3-Reference 1) consisted of slow-load testing five specimen configurations (detailed on drawings number 25-20341, 25-20367, 25-20372, 25-20376, and 25-20378) at a rate of 180 pounds per minutes, and rapid-load testing of two specimen configurations (detailed on drawings number 25-20341 and 25-20376) at a rate of 94,000 pounds per minute. All specimens were instrumented with deflection clips used in conjunction with the photographic-deflection-measurement technique. Four of the slow-load tested specimens (25-20367, 25-20372, 25-20376, and 25-20378) were instrumented with rosette strain gages.

\*SPL - Sonic Pressure Level

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### Volume II

THERMAL GRADIENT TEST DATA

### Volume III

THERMAL GRADIENT TEST DATA

LOAD TEST DATA

## 3.3

REFERENCES

1. D2-6783-1 Structural Integrity Development and Test Program - Detail Plan - Structures Technology
2. Leading Edge Segment - Forward Body (Test Only) 25-20372
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INTRODUCTION

In November of 1960 five forward body leading edge concepts were chosen for evaluation. A total of ten specimens were subjected to simulated flight test conditions for comparative evaluation. The following sequence of tests were performed on the specimens:

1. Sonic - 152.5 db normal incident random sound.
2. Thermal cycles - Four cycles to 2700° F.  
One cycle to 3000° F.
3. Sonic - 155.5 db normal incident random sound.
4. Ultimate Load - Load rates 180 pounds per minute and  
94,000 pounds per minute.

These tests were conducted to obtain fatigue, thermal stress, and oxidation resistance properties since empirical test data was required to evaluate complex structures and to verify analytical design procedures.

This is the third section of three of D2-800<sup>25</sup> covering the testing of X-20 leading edge concepts and consists of three volumes. See Sections 1 and 2 for plasma jet shroud testing of concepts having the same external configuration.

### 3.5 TEST SPECIMEN AND INSTRUMENTATION

#### 3.5.1 Test Specimen

3.5.1.1 A typical leading edge test specimen assembly, mounted and ready for sonic testing, is shown in Figure 3-1. Each specimen assembly consisted of two parts: (1) A leading edge segment fabricated from molybdenum -0.5% titanium alloy with an oxidation-resistant coating of molybdenum disilicide; and (2) a backup structure from Rene' 41 material. During thermal cycling, simulated heat shields coated with Mo-.5Ti skin were added as shown in Figure 3-2 to provide the proper thermal environment on the leading edge and leading edge beam.

3.5.1.2 Two preliminary coating processes were used to apply the molybdenum disilicide coating: (1) SPZ-1 (pack cementation); and (2) SPZ-4 (fluidized bed). The process by which the coating was applied varied with each specimen and is tabulated below:

| <u>Boeing Drawing Number</u> | <u>Specimen No.</u> | <u>Description</u>  | <u>Coating Process</u>          |
|------------------------------|---------------------|---|---------------------------------|
| 25-20372                     | 1                   | DS L.E. Unstiffened Single Shell                          | SPZ-1                           |
| 25-20372                     | 2                   | DS L.E. Unstiffened Single Shell                          | SPZ-1                           |
| 25-20367                     | 1                   | DS L.E. Double Skin Long Segments                         | SPZ-1                           |
| 25-20367                     | 2                   | DS L.E. Double Skin Long Segments                         | SPZ-4                           |
| 25-20378                     | 1                   | DS L.E. Double Skin Short Segments                        | SPZ-4                           |
| 25-20378                     | 2                   | DS L.E. Double Skin Short Segments                        | SPZ-4                           |
| 25-20341                     | 1                   | DS L.E. Unstiffened Shell Corners Reinforced Single Shell | SPZ-1                           |
| 25-20341                     | 2                   | DS L.E. Unstiffened Shell Corners Reinforced Single Shell | SPZ-1                           |
| 25-20376                     | 1                   | DS L.E. Riveted Ribs Single Shell                         | SPZ-4 Details<br>SPZ-1 Assembly |
| 25-20376                     | 2                   | DS L.E. Riveted Ribs Single Shell                         | SPZ-4 Details<br>SPZ-1 Assembly |

 Boeing drawing lot and specimen numbers are used interchangeably as dash numbers to the basic Boeing drawing number in this document.

3.5.2 Instrumentation

3.5.2.1 For the sonic test phase, two non-contact deflection pickups were used to monitor the specimen structural response and the sonic environment was monitored with one Altec 21BR-200 microphone located in front of each specimen as shown in Fig. 3-3.

3.5.2.2 For the thermal cycle test phase, each specimen was instrumented with eleven, 22 gage, refrasil insulated, chromel vs. alumel thermocouples, and eighteen platinum vs. platinum 13% rhodium alloy thermocouple probes.

3.5.2.2.1 The chromel vs. alumel thermocouples were spot welded to the Rene 41 backup structure, and the platinum probes were positioned on the leading edge segment and heat shields.

3.5.2.2.2 The probe type thermocouples consisted of a platinum vs. platinum 13% rhodium alloy thermocouple encased in a 12-inch long, 0.125-inch diameter alumina insulator. The thermocouple was spotwelded to a 0.025-inch thick platinum disc, 0.250-inch in diameter, which was then flame sprayed with a 0.005-inch layer of alumina to prevent reaction of platinum with the disilicide coating. Spring loaded holders (Fig. 3-4) were used to position the probes against the test specimen surface.

3.5.2.2.3 Monitor thermocouple locations are shown in Figs. 3-5 through 3-14. and control thermocouple locations are shown in Fig. 3-15 and 3-16.

3.5.2.3 All of the specimens that were load tested were instrumented with deflection clips used with the photographic-deflection-measurement technique. Clip locations are shown in Figure 3-17. Four of the specimens tested (detailed on drawings number 25-20367, 25-20372, 25-20376, and 25-20378) were also instrumented with rosette strain gages as shown in Figures 3-18 through 3-21. Photographs of each specimen in Figures 3-22 through 3-31 illustrate instrumentation before testing.

### 3.6

#### TEST SETUP

3.6.1 For sonic testing, the leading edge test specimen backup structure was bolted to a steel jig (Fig. 3-1) which was, in turn, bolted to floor tie-down rails such that the specimen leading edge was positioned approximately three feet inside the progressive wave horn chamber (Fig. 3-32).

3.6.1.1 The random noise source consisted of four Altec-Lansing Model 6786 electro-pneumatic transducers mounted at the throat of the progressive wave horn (Fig. 3-33). Power to the transducers was supplied by two 200 watt McIntosh Amplifiers. Shaping of the test spectrum was accomplished using an Allison 3-man-9 noise generator and octave band equalizer. A schematic diagram of the facility control system is shown in Fig. 3-34.

3.6.2 The test fixture used for thermally cycling the leading edge specimens is shown in Fig. 3-35. The specimens were held in position on a table of alumina brick with "L" shaped clamping bolts. A stainless steel support, shaped to conform to the curvature of the leading edge, positioned the lamps. The fixture was hinged so the lamp assemblies could be rotated up and away to facilitate specimen installation and inspection. Fig. 3-36 shows the test fixture in the open position.

3.6.2.1 General Electric 1600F13 quartz tube heating elements were used in air-cooled ceramic reflectors. The cooling air was distributed to each lamp assembly by means of an aluminum alloy manifold and copper tubing. The lamps were installed approximately one-half to three-quarters of an inch above the specimen surface.

3.6.2.2 Seven heat control zones were used. Each control zone required an ignitron power controller and an operator to manually control it. The required heat programs were drawn on the strip chart of the respective control recorders. During the test the operators manually adjusted the power to raise or lower the heat input to the specimen according to the program demand. A single Leeds-Northrup Speedomax G recorder was used for each control zone at a chart speed of six inches per minute. The temperature traces for each heat cycle were produced with a different color ink so the same programs could be re-used.

3.6.2.3 The external surface of the heat shield was not to exceed 2700° F. Since the control thermocouple was internally mounted, an extra recorder was used for each heat shield to monitor the external surface temperature. The chart speed for these recorders was one-half inch per minute.

3.6.3 The test fixture for load testing is shown in Figure 3-37. Load was applied through a loading head consisting of a curved rubber block backed up by wood and aluminum. The applied load was reacted through a back-up structure on which the specimen was mounted.

3.6.3.1 Two sheets of teflon were placed between the rubber and specimen to decrease friction and to minimize tangential loads on the curved surface of the specimen. Cutouts in the teflon which allowed clearance for the rosette gages and lead wires were filled with potting compound to maintain load continuity over the test specimen surface.

3.6.3.2 The setup sequence upon receipt of each specimen was to install gages and deflection clips, install teflon sheets, pot the cutouts, and mount the specimen in the test fixture.

### 3.7 TEST PROCEDURE

#### 3.7.1 Sonic Test Program LT 5-617-1 (Fig. 3-38)

3.7.1.1 Each specimen was exposed to a random noise environment of 152.5 db SPL (overall) for 30 minutes. The microphone and deflection pickups were tape recorded during the initial portion of each test phase for later spectral analysis and amplitude distribution analysis. Octave band analysis was made at the start of each test.

3.7.1.2 The specimens, upon return from thermal cycling per LT 5-617-2, (see 3.7.2) were subjected to an additional 30 minutes at 152.5 db. An octave band analysis of the microphone and deflection pickup outputs were again tape recorded during the first 10 minutes of the test. After 15 minutes the test was interrupted for specimen inspection after which the remaining 15 minutes of testing were completed.

3.7.1.3 The final phase of the sonic test program consisted of subjecting each test specimen to a random noise environment of 155.5 db SPL (overall) for 30 minutes. The spectrum of this phase was 3 db higher in all octave bands than the previous phases. The specimens were visually inspected at 5 minutes, 15 minutes, and at the conclusion of the 30 minute test. The output of the microphone and the two deflection pickups were tape recorded at the beginning of the test. A 5 cps bandwidth power spectral density analysis was made of the microphone and pickup outputs for the first and final test periods for each specimen. This data was stored with sonic test facility.

#### 3.7.2 Heat Test Program LT 5-617-2 (Figs. 3-39 and 3-40)

3.7.2.1 The test specimens were delivered to the Heat Laboratory after completion of the initial phase of the sonic test program. To facilitate the temperature control of the backup structure and simulated heat shields, the fibrefrax insulation between them was removed for testing and chromel vs. alumel thermocouples were spotwelded to the backup structure. The specimen was positioned on the alumina brick test bed and locked in place with "L" shaped bolts. One-eighth inch fibrefrax board was cut to fit snugly in the ends of the specimen to reduce air circulation. The final step in specimen preparation was to mount the thermocouple probe-type sensors on the external surface.

3.7.2.2 Each leading edge test specimen was subjected to the heat program shown in Fig. 3-39 and 3-40. The heat program consisted of four 40 minute heat cycles followed by a 10 minute heat pulse. Maximum temperatures of 2700°F during the 40 minute cycle and 3000°F during the 10 minute pulse were attained. The simulated heat shields were subjected to two or three of the above-mentioned heat programs because only four sets of heat shields were fabricated for the ten leading edge heat programs conducted. Where failures to the disilicide coating on the simulated heat shields had occurred, Sears Roebuck furnace cement was applied to retard further erosion.

3.7.3      Room Temperature Load Test LT5-617-3

3.7.3.1     Five specimens, 25-20367, 25-20372, 25-20376, 25-20378, and 25-20341, were slow-load tested at 180 pounds per minute, and two specimens, 25-20341-2 and 25-20376-2, were rapid-load tested at 94,000 pounds per minute.

3.7.3.2     The four slow-load specimens, 25-20367, 25-20372, 25-20376, and 25-20378, were instrumented with rosette strain gages and loaded in increments of 100 pounds. Strain data recorded was recorded at each load increment.

3.7.3.3     During the loading of the specimens, photographs were taken of the specimens and the load dial simultaneously at regular intervals (ten-second intervals for slow-loading and sixteen frames per second for the rapid-loading). The motion of graduated clips and pointed screws attached to the specimen at critical deflection points was recorded relative to a grid placed over the camera lens. Fig. 3-41 shows a typical specimen with zero load and maximum load. The grid indicates the deflection.

3.8

TEST RESULTS

3.8.1

Sonic Test

3.8.1.1

None of the ~~eten~~ specimens tested developed visible failures due to sonic excitation. Photos of the tested specimens are shown in Figs. 3-42 through 3-52.

3.8.1.2

All ~~eten~~ sonic environment amplitudes exceeded the required peak/rms ratio of 3. Plots showing the test runs with the minimum and the maximum amplitude distribution curves are on Fig. 3-110. All of the other test runs were within these limits.

3.8.1.3

Plots of the sonic test spectrum for each specimen tested are shown on Figs. 3-111 through 3-120.

3.8.2

Thermal Cycle Test

3.8.2.1

Time versus temperature strip chart records of each control thermocouple were obtained for each specimen. No data was reduced from these records except the plots for typical test runs as shown in Figs. 3-53 through 3-58.

3.8.2.2

The monitor thermocouple tabulated data has been included in this report in Volumes 2 and 3. For comparative purposes, photographs of specimens before and after heat cyclic testing are presented in Figs. 3-59 through 3-86.

3.8.3

Room Temperature Load Test

3.8.3.1

Load versus deflection data is tabulated for each of the slow-load specimens in Volume 3 of this document. All rosette strain gage data is presented in Volume 3.

3.8.3.2

Load versus time curves for the two rapid-load specimens and load versus deflection data are presented in Volume 3. For specimen 25-20376-2, the first load cycle was considered invalid (see 3.9.2.3), so none of the data was tabulated.

3.8.3.3

Photographs of all of the specimens after load testing are presented in Figs. 3-87 through 3-104. X-ray photographs of the slow-load tested specimens are presented in Figs. 3-105 through 3-109.

**3.9 TEST OBSERVATIONS**

**3.9.1 Thermal Gradient Test**

**3.9.1.1 Specimen 25-20372-1**

Before the heat test, the surface of the leading edge was mottled and pitted, but there were no breaks in the disilicide coating (Fig. 3-59). Three minutes after the start of the third cycle, the test was halted due to a short circuit between two lamps. The lamps and a thermocouple had to be repaired. Then testing was completed. No tabulated data was recorded after 700 seconds in the third cycle due to a cracked recording head in the digital data system. After the heat test (Fig. 3-60), there was no apparent coating failure.

**3.9.1.2 Specimen 25-20372-2**

Fig. 3-61 shows pretest condition, and Fig. 3-62 shows no coating failures after 5 tests.

**3.9.1.3 Specimen 25-20367-1**

Fig. 3-63 shows pretest condition. There was no noticeable damage to the specimen after 5 heat cycles (Fig. 3-64 and 3-65).

**3.9.1.4 Specimen 25-20367-2**

Fig. 3-66 shows pretest condition. The heat shields from a previous test were reused on this specimen. Fig. 3-67 and 3-68 show post test results. The eroded heat shields have been repaired with Sears Roebuck Furnace Cement. The coating on the leading edge segment became a little mottled, but no failures occurred.

**3.9.1.5 Specimen 25-20378-1**

Fig. 3-69 shows pretest condition. During the second heat cycle, a platinum thermocouple came in contact with the heat shield under Zone 1 and caused a small hole to erode (Fig. 3-70). The hole was patched with Sears Roebuck Furnace Cement and testing continued. After the fourth heat cycle, it was found that Zone 2 had been over-heated an undetermined amount (Figs. 3-70 and 3-71). This was apparently caused by the control thermocouple shifting position during the test. Fig. 3-72 shows the Zone 7 side. Fig. 3-73 shows coating failure after 3000°F heat pulse.

**3.9.1.6 Specimen 25-20378-2**

Fig. 3-74 shows the heat shield on Zone 1 side of specimen eroded around edges. The coating failed around some of the rivets, and a one-quarter inch hole eroded under the control thermocouple. Fig. 3-75 shows the area under Zone 6 glazed due to over-heating, and a small hole eroded at the control thermocouple location.

**3.9.1.7 Specimen 25-20378-2**

### 3.9.1.7 Specimen 25-20341-1

Fig. 3-76 shows pretest condition and Fig. 3-77 shows no noticeable coating failure after heat tests. The ten minute heat pulse had to be repeated. An over-temperature switch was set incorrectly and the power to Zone 4 was cut off each time the temperature exceeded 2200°F.

### 3.9.1.8 Specimen 25-20341-2

Fig. 3-78 shows pretest condition. Figs. 3-79 and 3-80 show specimen after heat tests. A rivet on the Zone 7 heat shield failed during tests.

### 3.9.1.9 Specimen 25-20376-1

The hole around the rivet on the leading edge, seen in the pretest photo in Fig. 3-81, was a manufacturing error. The heat shields had been used previously on 25-20378-2. Fig. 3-82 and 3-83 shows post-test condition. Only noticeable damage was further erosion of heat shields.

### 3.9.1.10 Specimen 25-20376-2

Fig. 3-84 shows pretest condition. One of the heat shields was cracked when it was mounted on the backup structure (Fig. 3-85). It was sealed with furnace cement. During the heat cycles, two rivets eroded in the heat shield (Fig. 3-86). There was no coating failure to the leading edge.

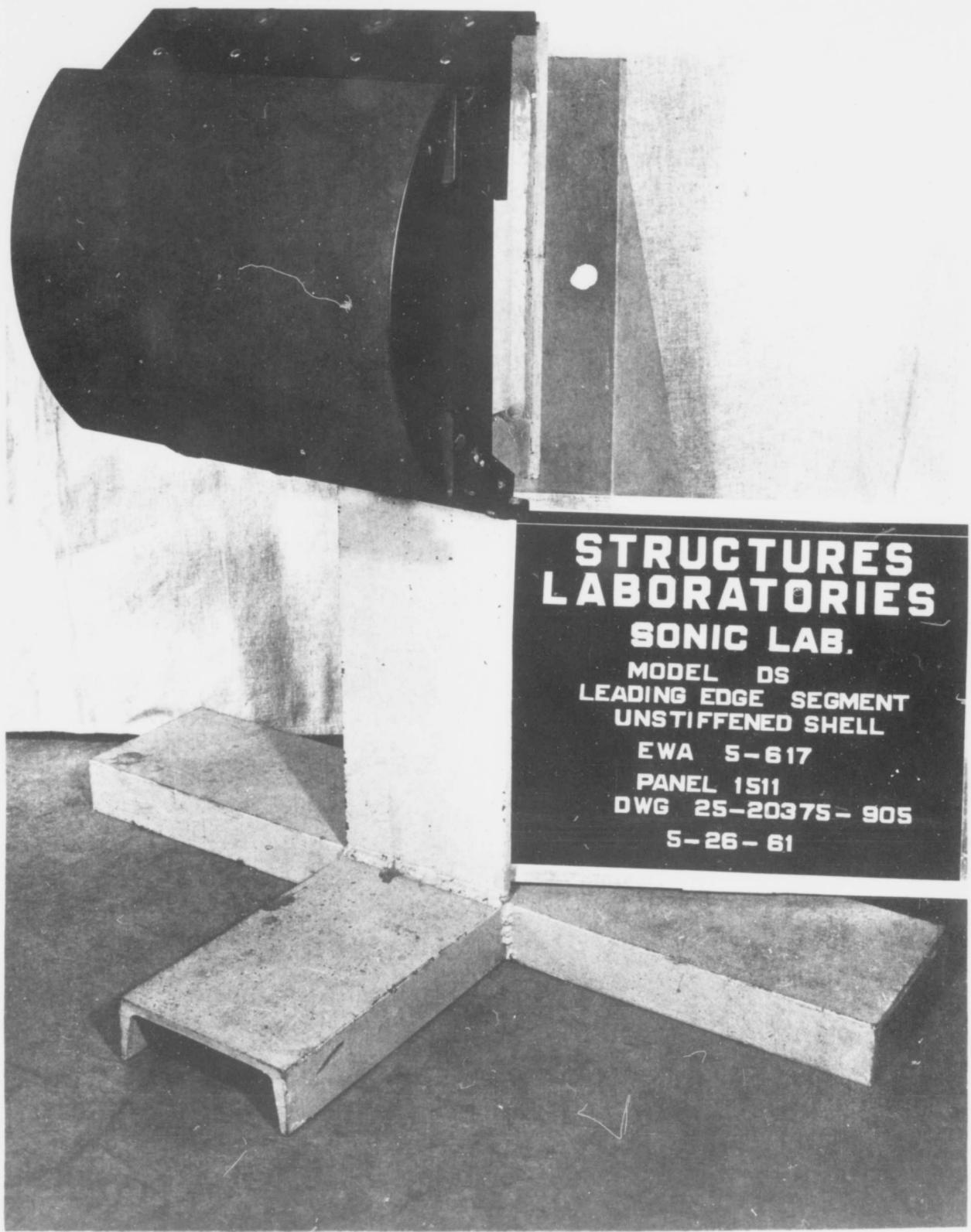
## 3.9.2 Load Test

3.9.2.1 Specimen 25-20376 failed at a load of 1988 pounds by brittle fracture of structural elements (Figs. 3-96, 3-97, 3-98, and 3-109) when it was slow-load tested.

3.9.2.2 The slow-load tests, on the first four specimens, resulted in unexpectedly high loads and plastic deformations. The possibility that strain-rate-sensitivity of the specimen material (Mo-0.5 Ti) would alter these results under higher load rates prompted further investigation through the rapid-load test program.

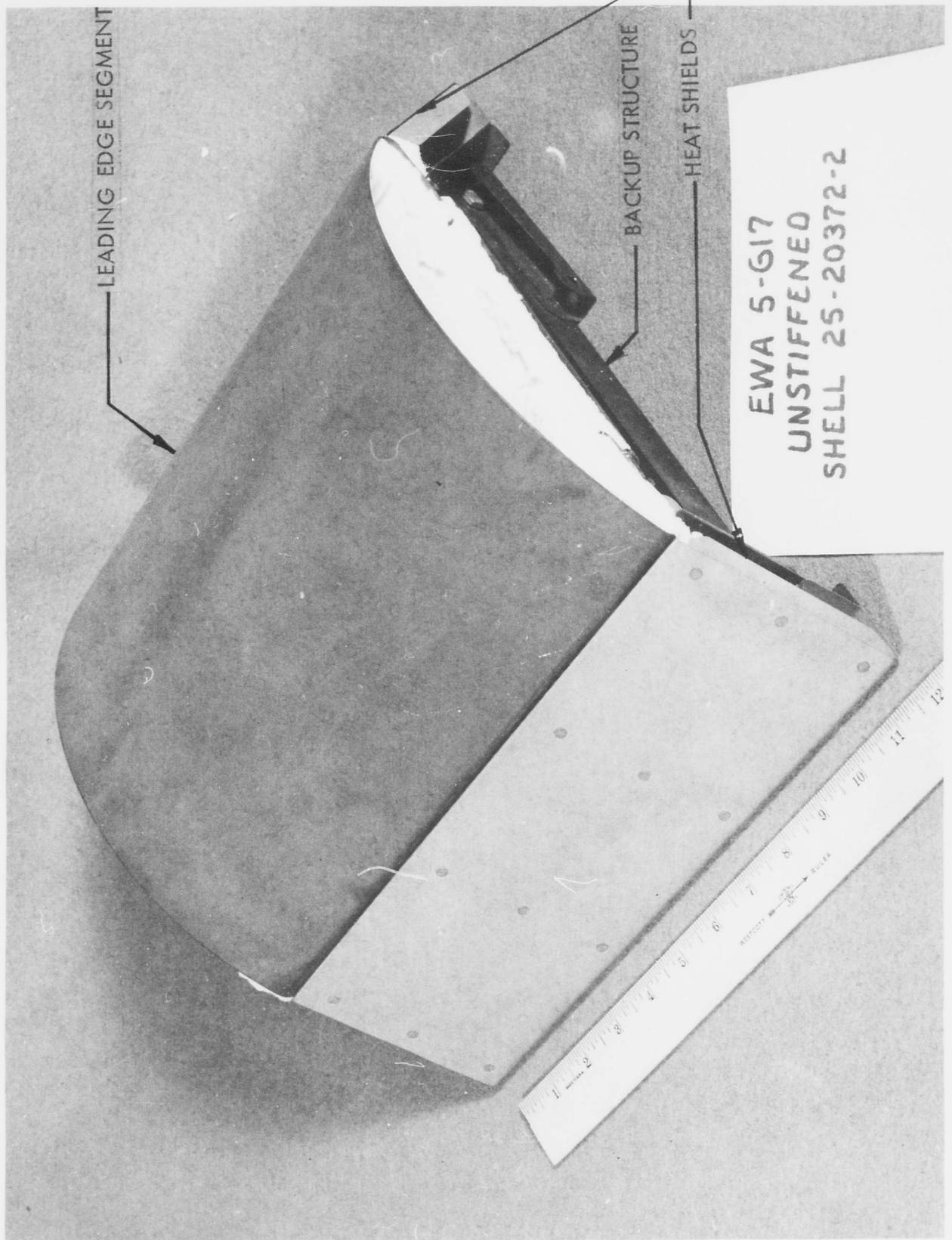
3.9.2.3 Both rapid-load specimens were inadvertently unloaded by an improperly set deflection switch. The switch was supposed to be set so the loading would be halted on failure of the specimen. Each specimen was loaded a second time to accomplish the desired test.

3.9.2.4 Specimen 25-20341-2 failed initially at a load of 1100 pounds when rapid-load tested. A delay in the test machine unloading system resulted in a maximum load of 2900 pounds being applied to the backup structure. Fig. 3-100 shows the failed specimen.



TYPICAL LEADING EDGE ON SONIC TEST FIXTURE  
SPECIMEN MOUNTED





TYPICAL LEADING EDGE SPECIMEN WITH HEAT SHIELDS INSTALLED

U3-4071-1000 (was BAC 1546-L-R3)

9-3-63

BOEING

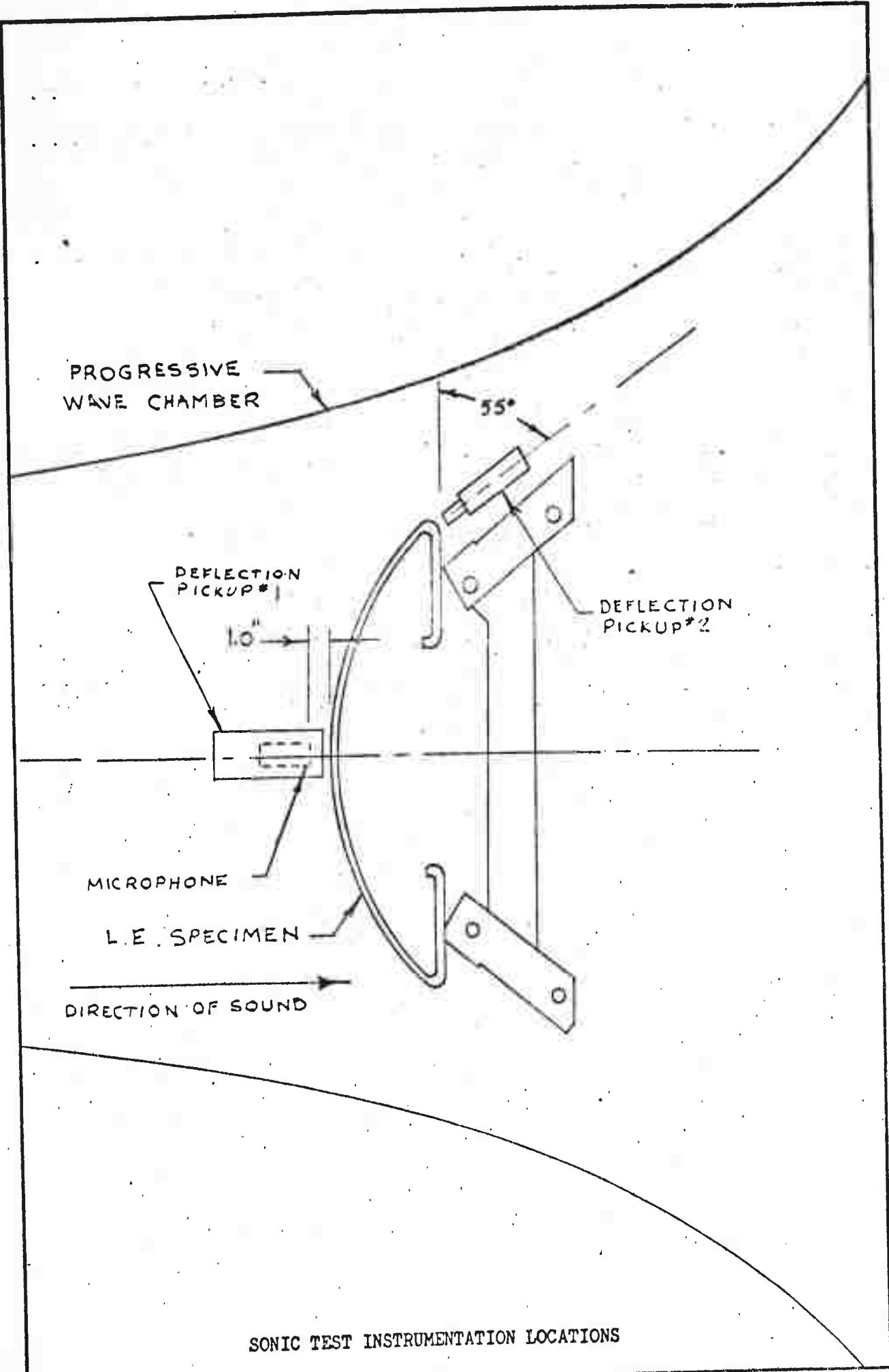
NO. D2-80035

Volume I

Fig. 3-2

PAGE 3-20



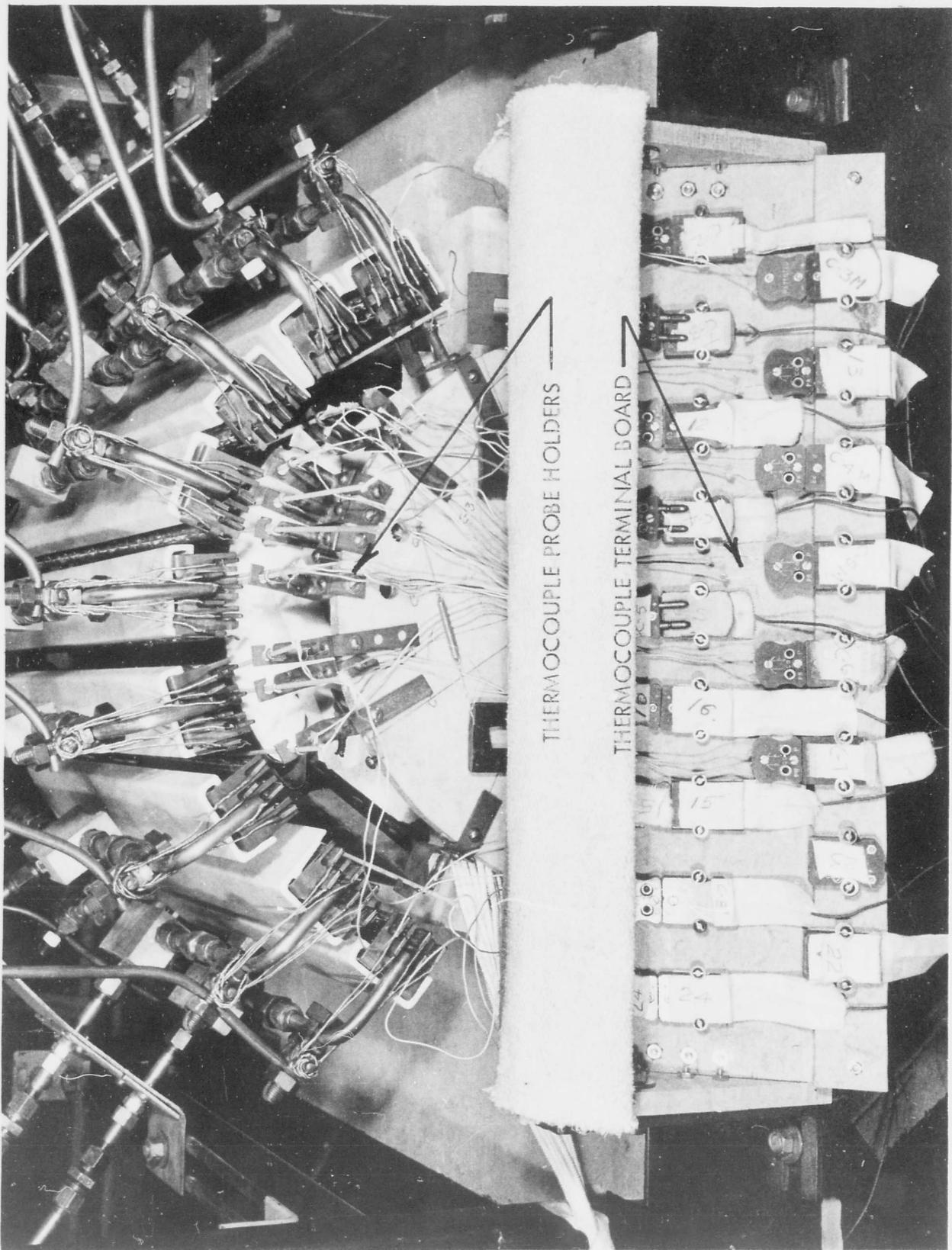


U3-40714-000

9-3-63

23

BOEING | NO. D2-80085  
 Volume I Sect. 3 | PAGE Fig. 3-3-1  
 3-21



U3-4071-1000 (was BAC 1546-L-R3)

## Volume I

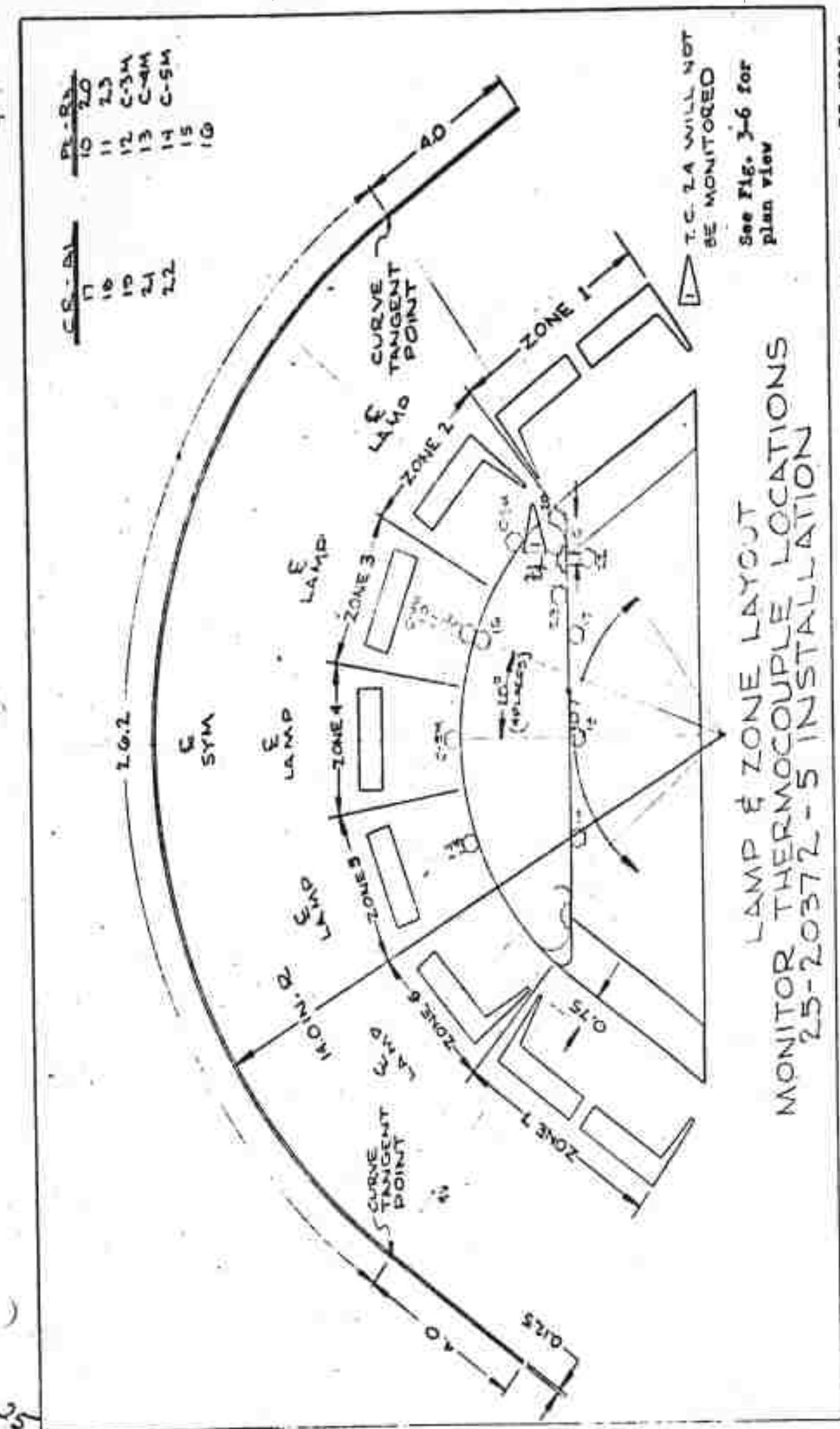
**BOEING**

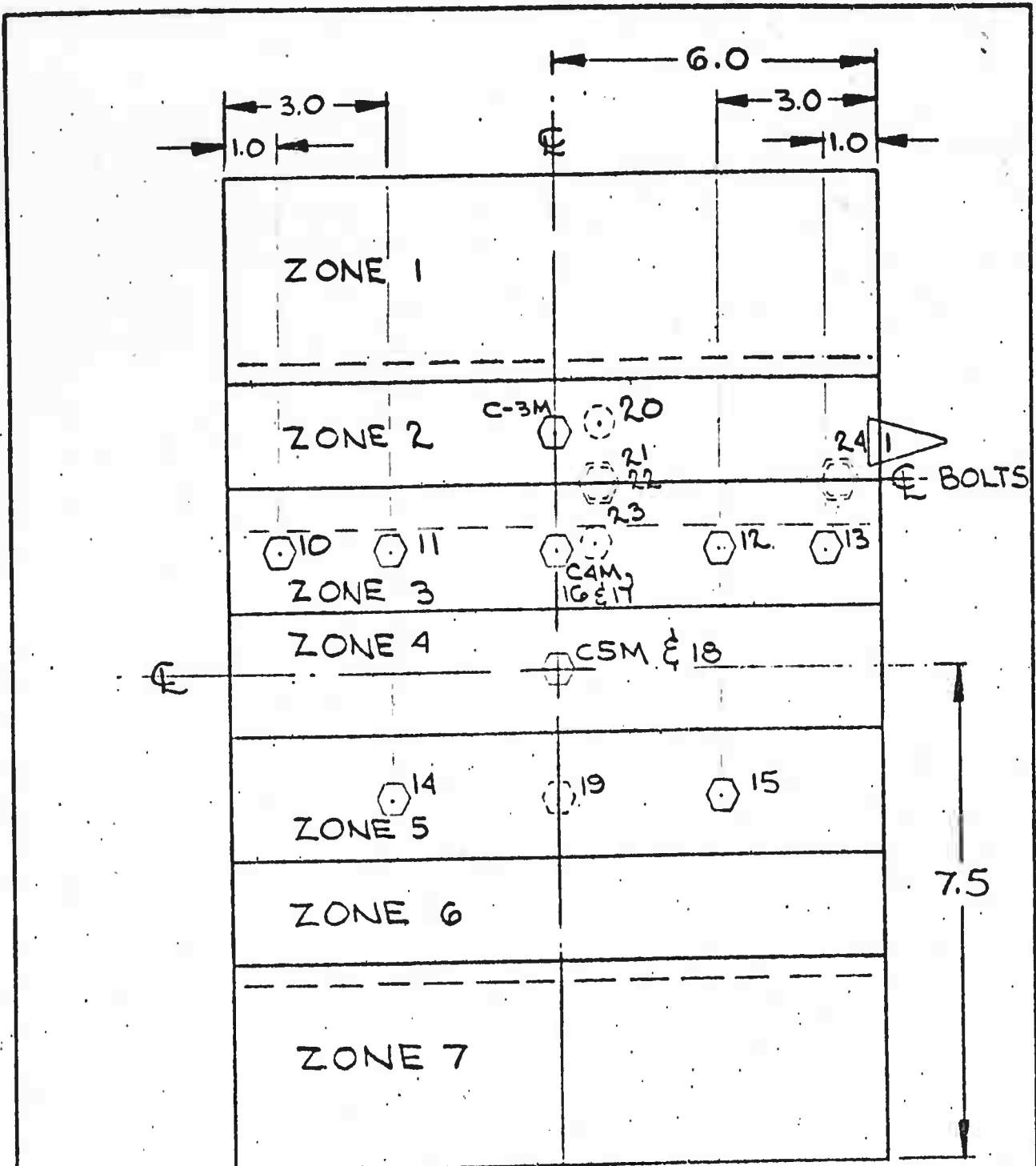
NO. D2-40055

Fig. 3-4

PAGE 8 of 8







► T.C. 24 WILL NOT BE MONITORED

| <u>Pt-Rh</u> | <u>CR-AL</u> |
|--------------|--------------|
| 10           | 16           |
| 11           | 20           |
| 12           | 23           |
| 13           | C-3M         |
| 14           | C-4M         |
| 15           | C-5M         |
|              | 17           |
|              | 18           |
|              | 19           |
|              | 21           |
|              | 22           |

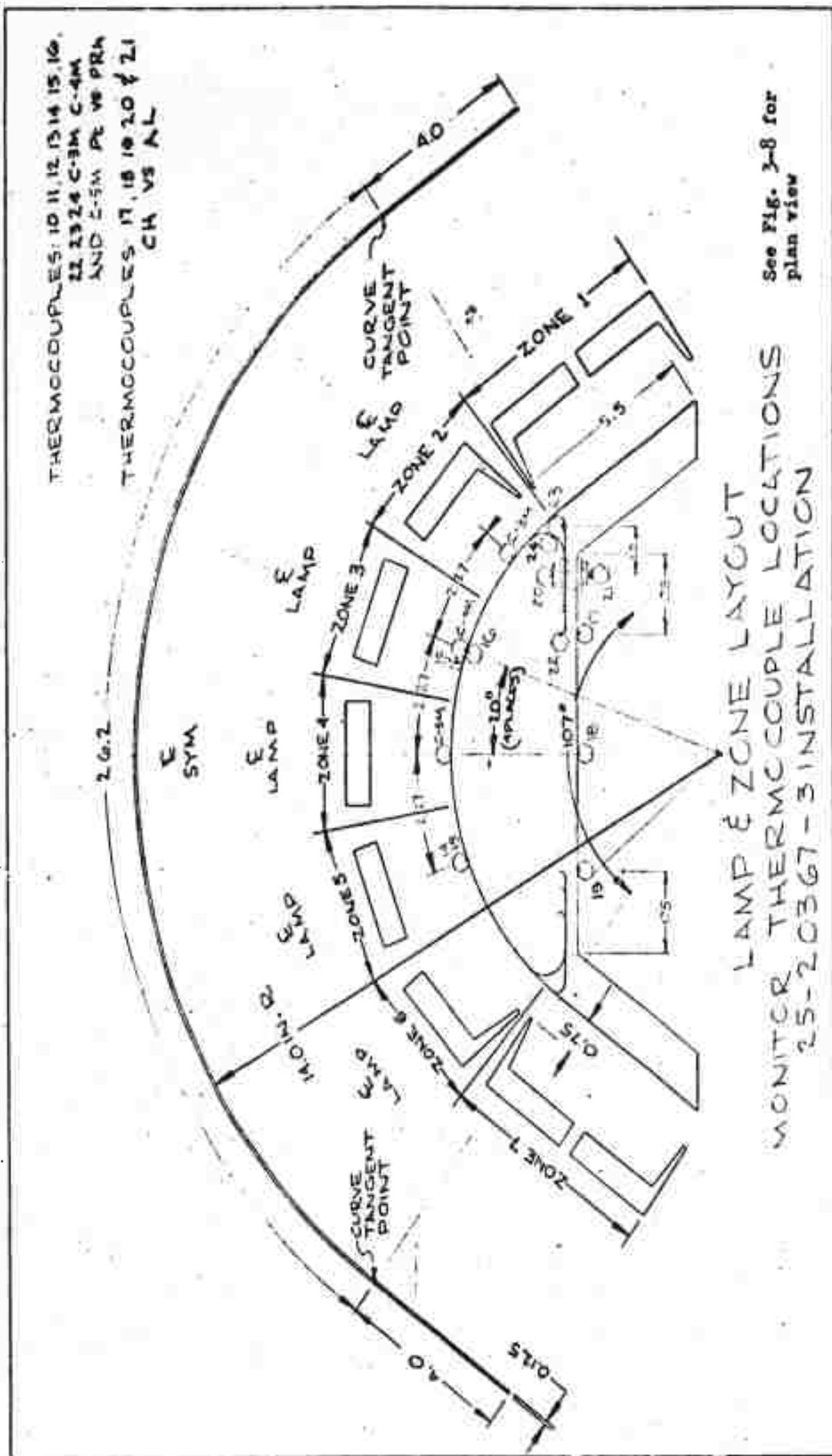
MONITOR THERMOCOUPLE LOCATIONS  
25-20372 - 5 INSTALLATION

THERMOCOUPLES: 10 II, 12, 13, 14, 15, 16,  
22, 23, 24, C-3M, C-4M,  
AND C-5M, RE VS PRK

THERMOCOUPLES 17, 18, 19, 20 & 21  
CH VS AL

-3.63

-3.63

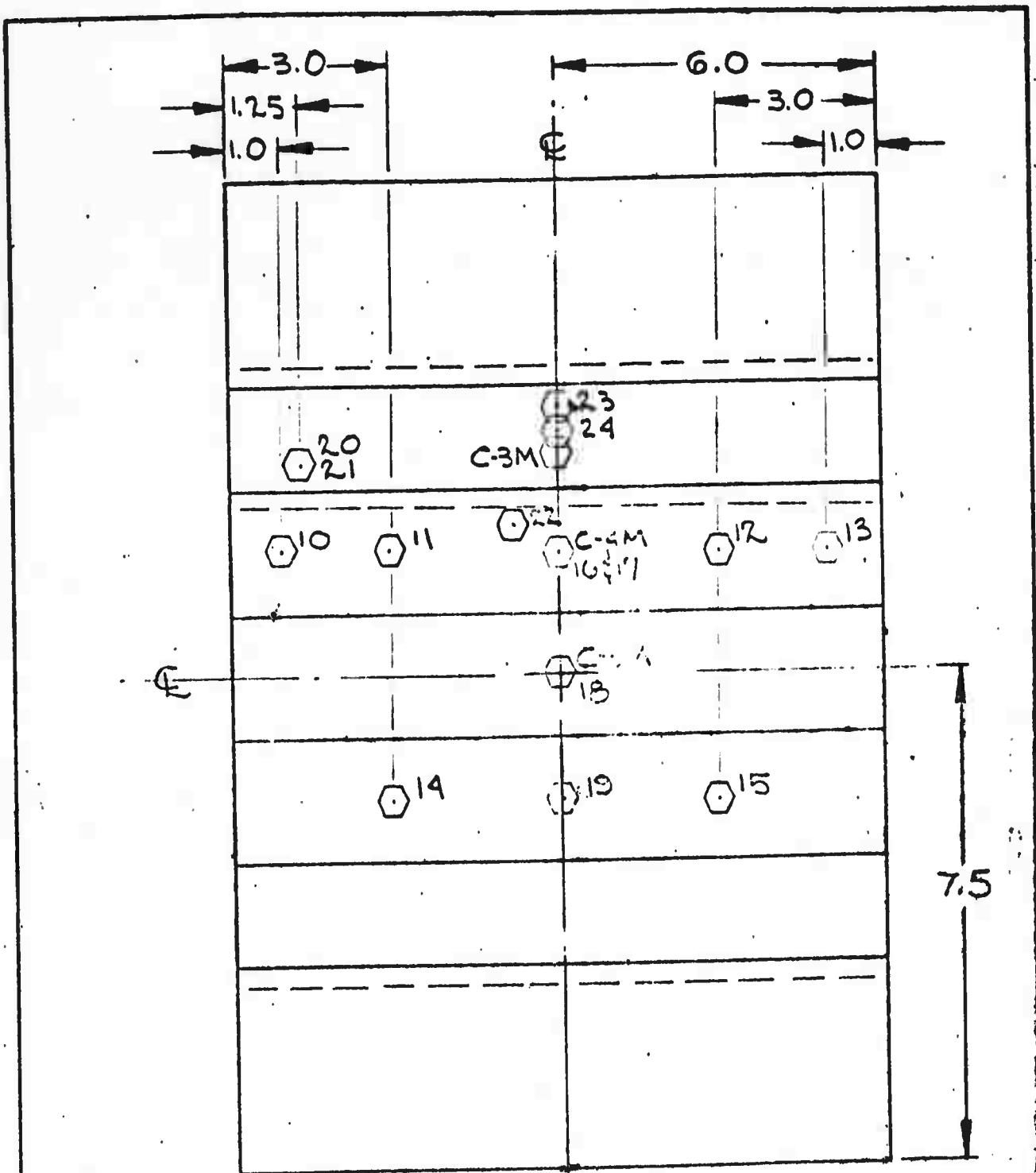


See Fig. 2-8 for  
plan view

CONCRETE THERMOCOUPLE LOCATIONS  
15-20367-3, INSTALLATION  
LAMP ZONE LOCATIONS

Volume I set 3  $\frac{1}{25}$  H.L. 30085

200



Pt vs. PRh

10 22  
11 23  
12 24  
13 C-3M  
14 C-4M  
15 C-5M  
16

CH vs. AL

17  
18  
19  
20  
21

MONITOR THERMOCOUPLE LOCATIONS  
25-20367 - 3 INSTALLATION

Thermocouples: 10, 11, 12, 13, 14, 15  
16, 20, 24, 25, 26, 27, 28  
at C-TIN are Pd-Pt/Pt1000-1000.

Thermocouples: 17, 18, 19, 20, 21, 22, 23  
at C-TIN are Pd-Pt/Pt1000-1000.

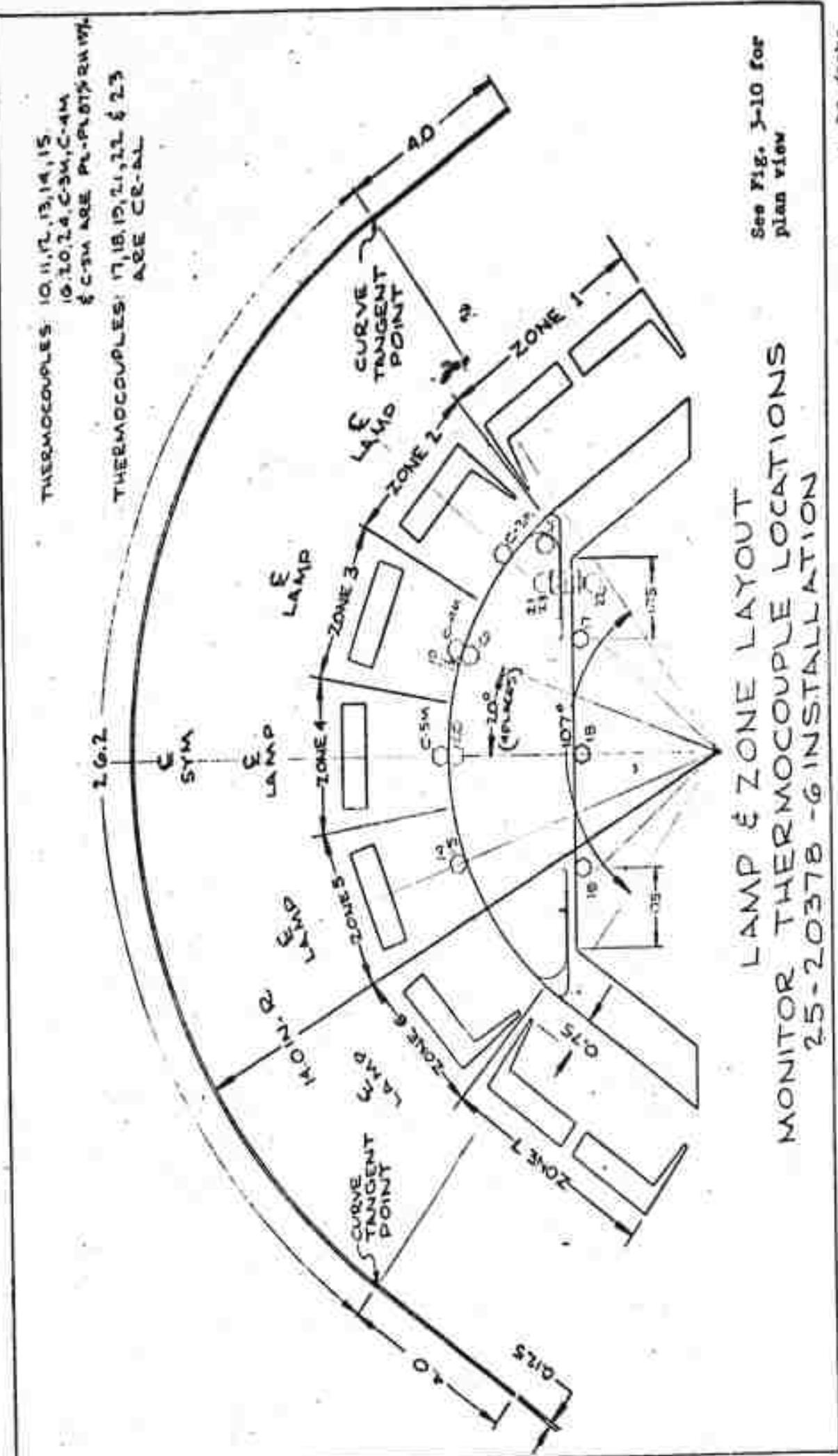
9-3-63

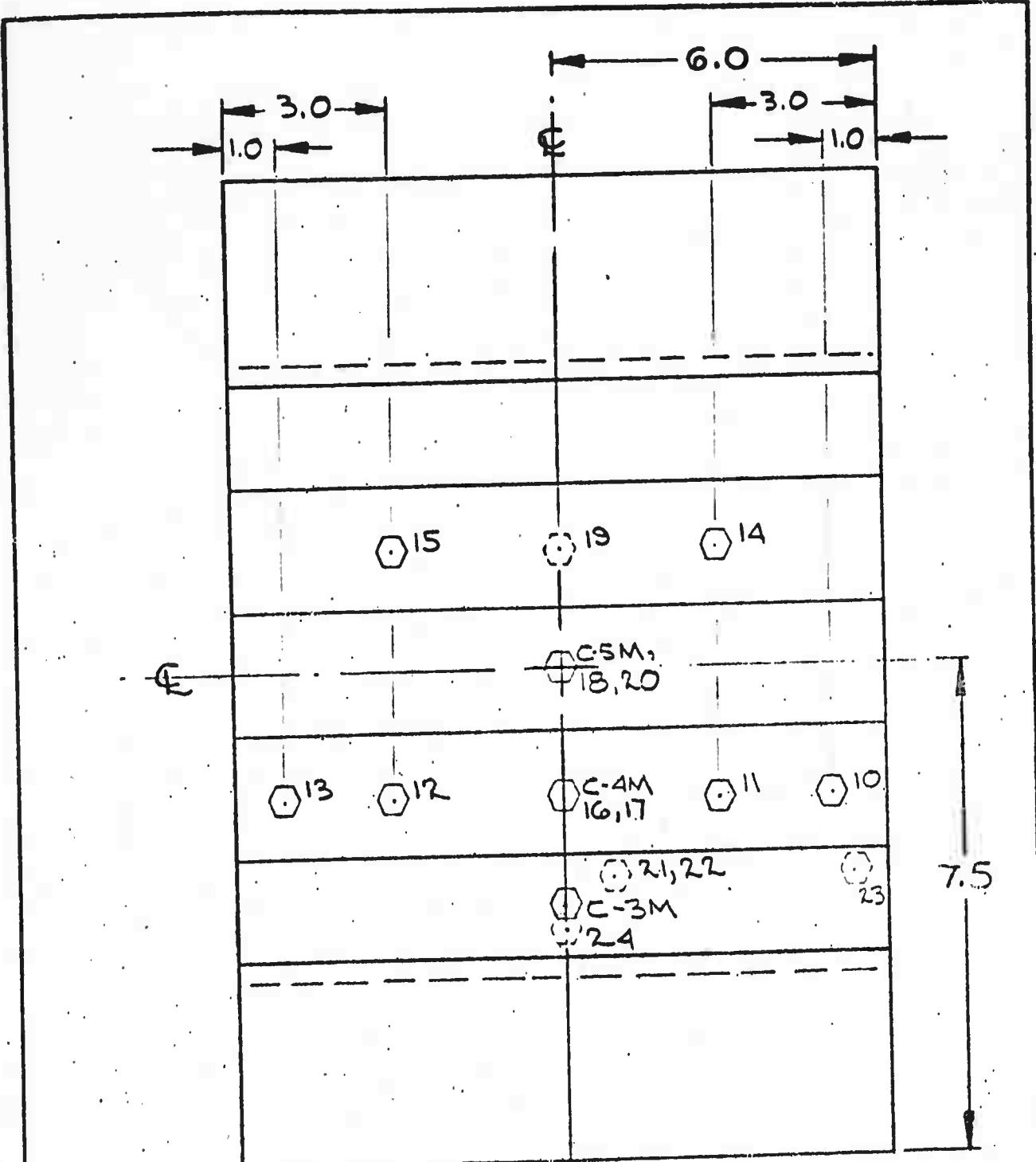
plan below

## MONITOR THEER MOCCOUPLE LOCATIONS 25-20378-6 INSTALR ATION

100

Volume I - 3 3-27 PLS. 3-41





Pt-Pt 87% RH 13%

CR-AL

|    |      |
|----|------|
| 10 | 16   |
| 11 | 20   |
| 12 | 24   |
| 13 | C-3m |
| 14 | C-4m |
| 15 | C-5m |

17  
18  
19  
21  
22  
23

MONITOR THERMOCOUPLE LOCATIONS  
25-20378 - 6 INSTALLATION

U1-4871-6000

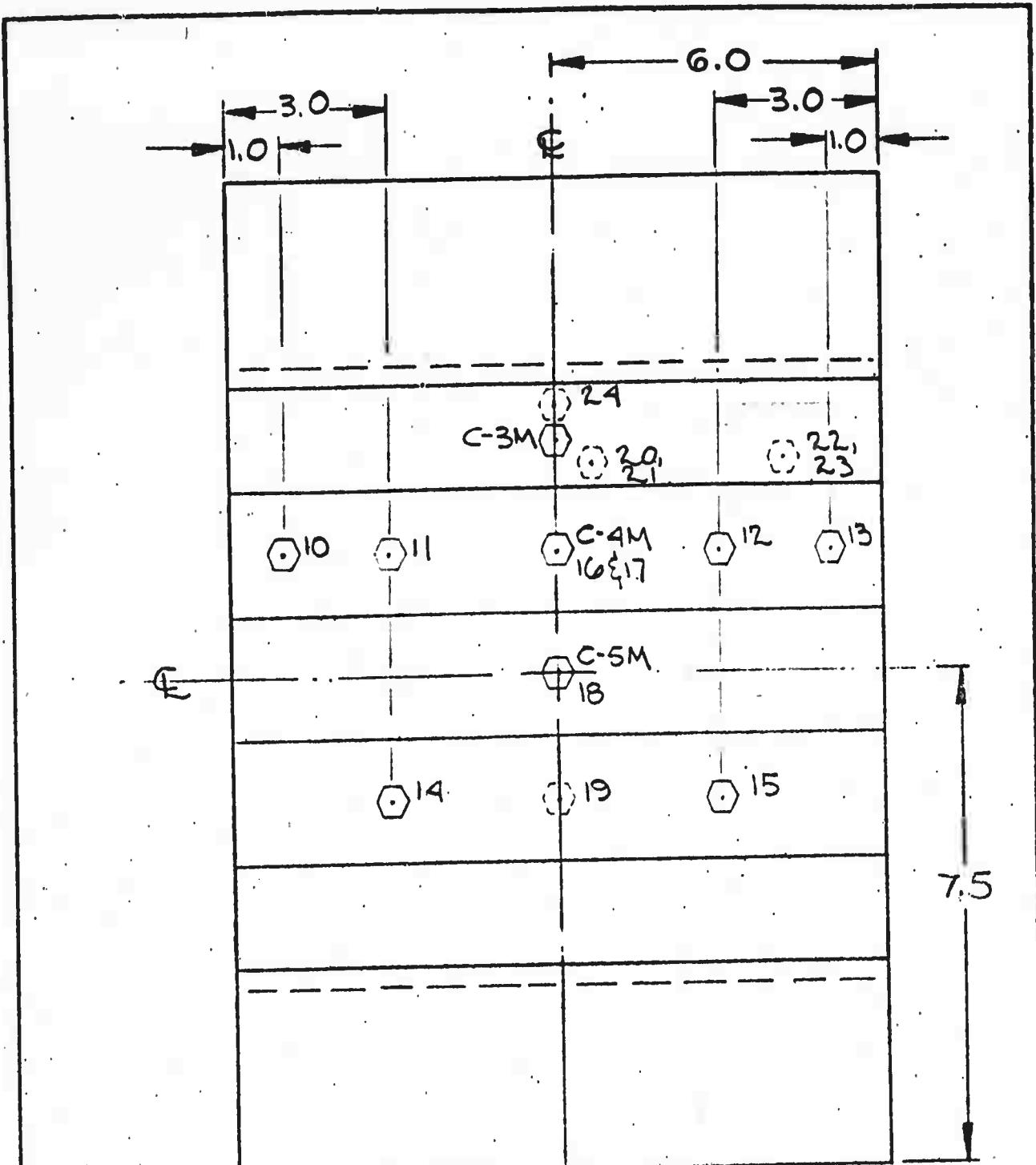
9-3-63

BOEING

NO. D2-80085

PAGE 3-20  
Fig. 3-10





Pt - Pt 87% Rh 13%

CR - AL

|    |      |
|----|------|
| 10 | 16   |
| 11 | 24   |
| 12 | C-3M |
| 13 | C-4M |
| 14 | C-5M |
| 15 |      |

|    |
|----|
| 17 |
| 18 |
| 19 |
| 20 |
| 21 |
| 22 |
| 23 |

MONITOR THERMOCOUPLE LOCATIONS  
25-20341 - 1 INSTALLATION

Thermocouples: 10, 11, 12, 13, 14, 15, 16,  
24, C-3M1, C-4M1, C-5M1  
ARE Pt - Cu.

272

574

6

CURVE  
TANGENT

2.  
2.  
2.

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10

CURVE  
TRACER

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CHIE 3

1

1

401

४३

CURVE  
TAKING  
POINT

1

A diagram showing a 2x2 grid of rectangles. The top-left rectangle is labeled 'ZONE 1' and the bottom-right rectangle is labeled 'ZONE 2'. The other two rectangles are empty.

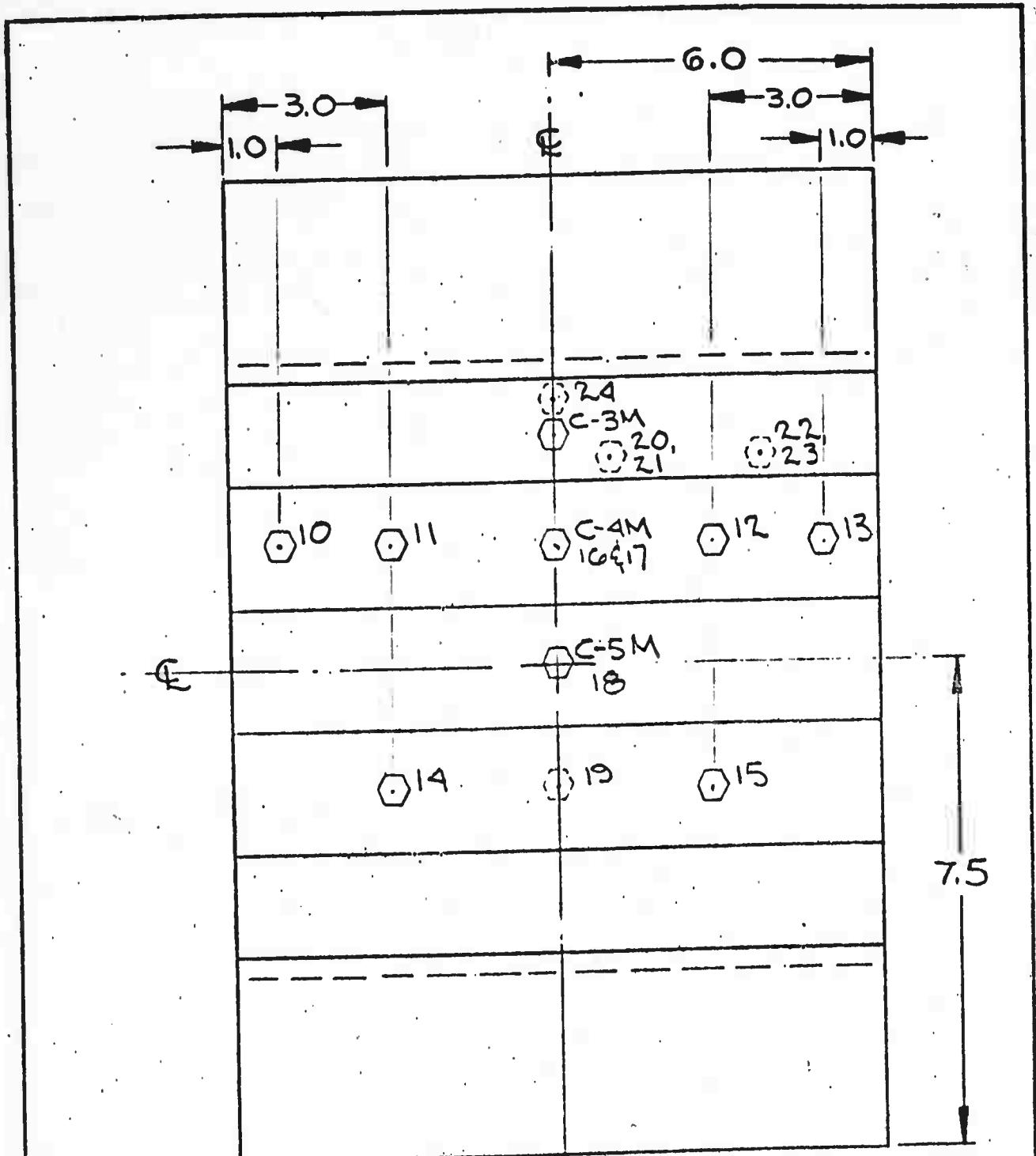
Q125

LAMP & ZONE LAYOUT  
MONITOR THERMOCOUPLE LOCATIONS  
35-36376-3 INSTALLATION

See Fig. 3-14 for

100

Volume I 5 D2-80085-1



| <u>Pt-Rh</u> |      | <u>CR-AL</u> |
|--------------|------|--------------|
| 10           | 16   | 17           |
| 11           | 24   | 18           |
| 12           | C-3M | 19           |
| 13           | C-4M | 20           |
| 14           | C-5M | 21           |
| 15           |      | 22           |
|              |      | 23           |

MONITOR THERMOCOUPLE LOCATIONS  
25-20376 - 2 INSTALLATION

THESE MEASURES, C-3 TAKE C-7 AND C-2, C-8, C-9 AND C-10, C-5 WILL HAVE EXTREME CARE BROUGHT OUT.

262

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CURVE  
TANGENT  
POINT

۱۰

2

17

172

四

11

12

10

1

1

1

10

5

100

56

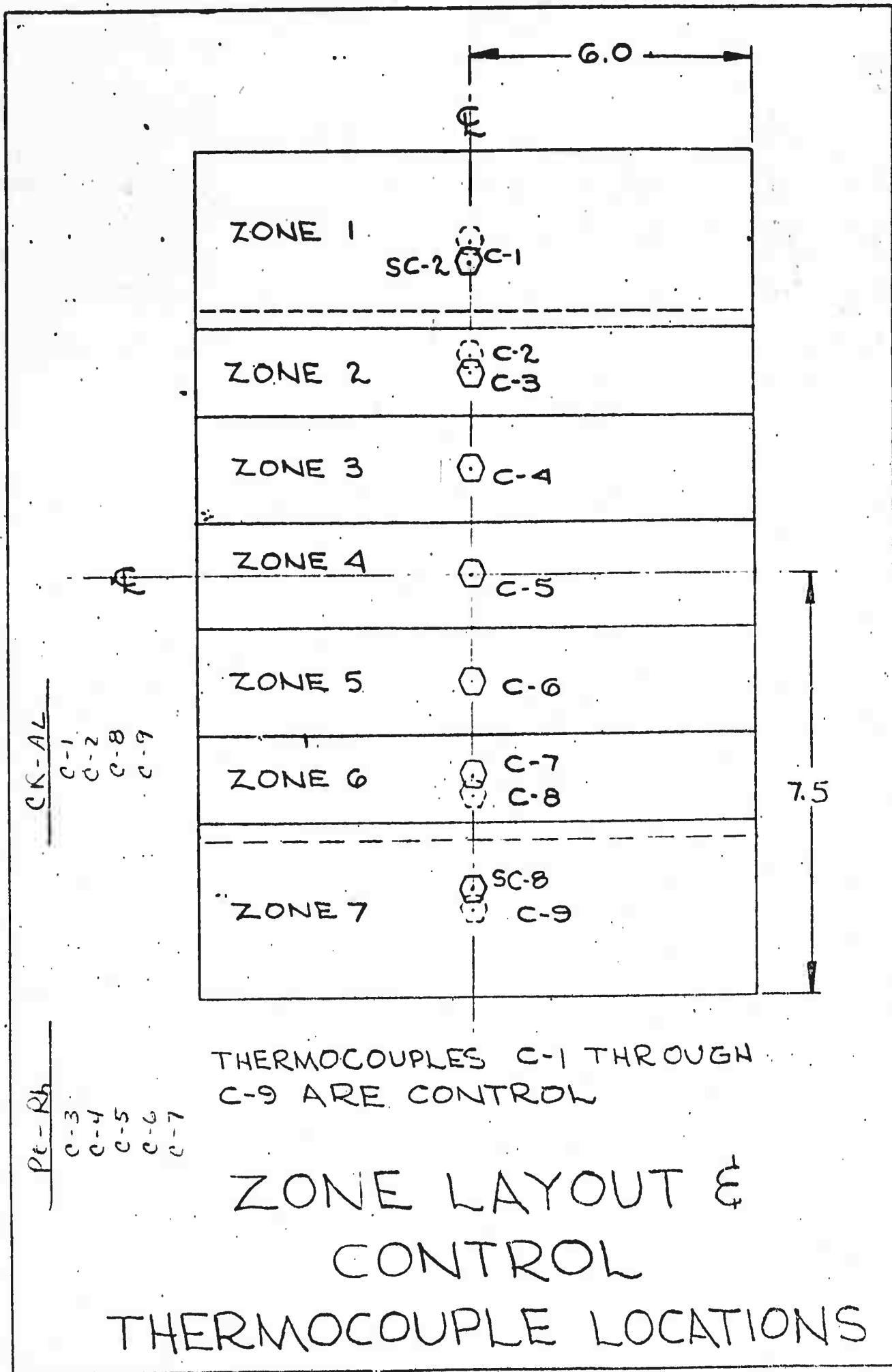
LAMP & ZONE LAYOUT  
CONTROL THERMO COUPLES

See Fig. 3-16 for  
plan view

10

2021-22 Volume 3, Fig. 3-15

9-3-63



REVISED 9-3-63

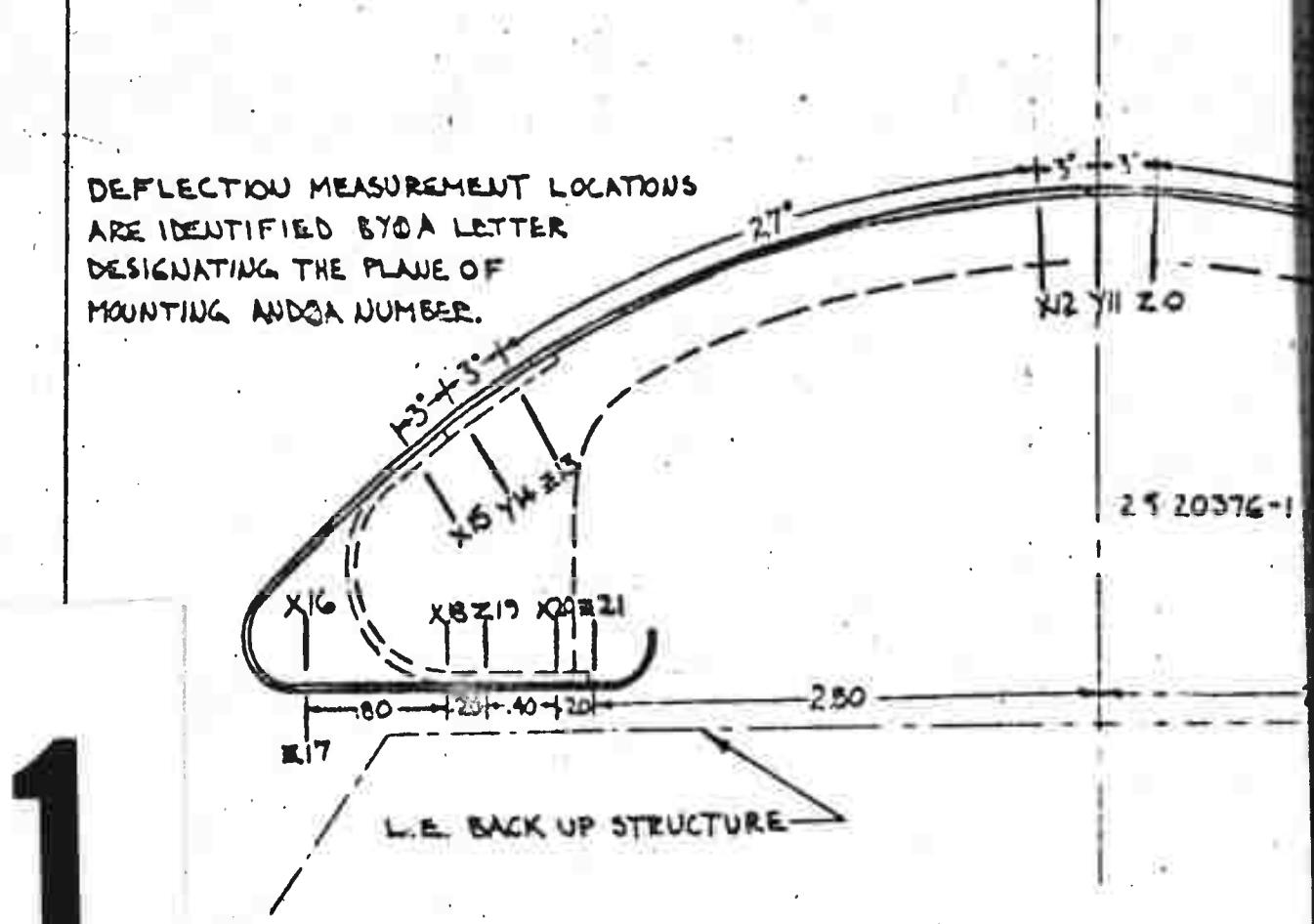
U3 4288 2000 (WAS BAC 4131D)

BOEING VOL 1 SEC. 3 NO D2-80085  
PAGE Fig. 3-16  
3-34

TABLE 1

| LEADING EDGE ASSEMBLY NO. | DIMENSION X  | DIMENSION Y | DIMENSION Z     | LOCATIONS NOT USED                                   | TOTAL NUM OF LOCAT |
|---------------------------|--------------|-------------|-----------------|--|--------------------|
| 25-20372-1                | 0            | 3.00        | 6.00            | —  | 21                 |
| 25-20378-1                | 0.75         | 3.00        | 6.00            | —  | 21                 |
| 25-20367-1                | 0.80         | 3.00        | 6.00            | —  | 21                 |
| 25-20376-1                | 0 (ON PLANE) | 3.00        | 6.33 (WINGSPAN) | X2, Z3, X4, X7, Y8, Z9, Z13, Y14, X15, X18, Z19, X20 | 9                  |
| 25-20341-1                | 0            | 3.00        | 6.00            | —  | 21                 |

DEFLECTION MEASUREMENT LOCATIONS  
ARE IDENTIFIED BY A LETTER  
DESIGNATING THE PLANE OF  
MOUNTING AND A NUMBER.

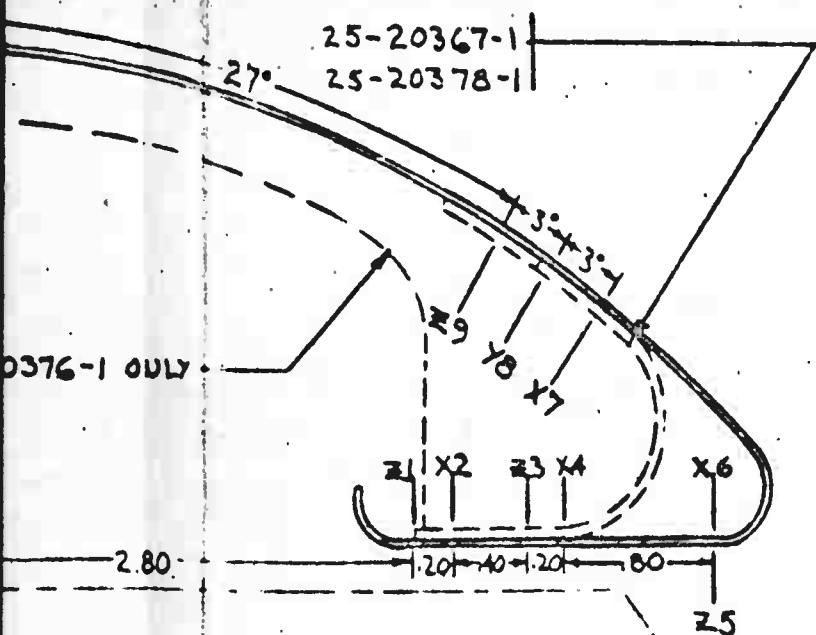
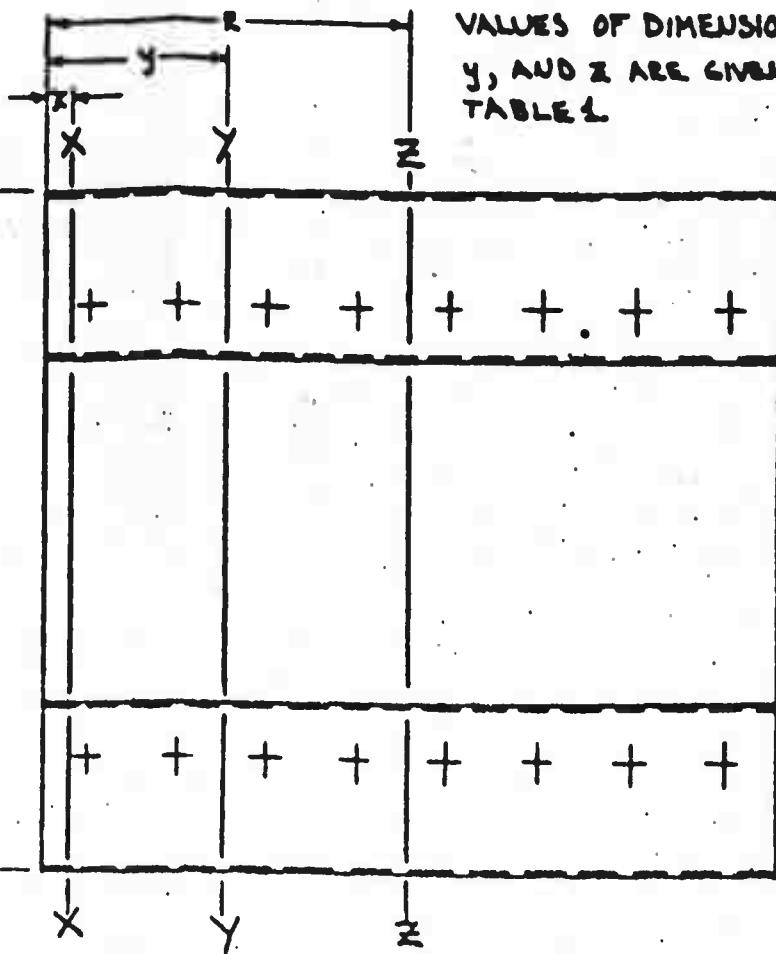


EWA 5-617 LEADING EDGE Cross SECT

REVISED 9-3-63

BAC 4339

| AL NUMBER | LOCATIONS |
|-----------|-----------|
| 21        |           |
| 21        |           |
| 21        |           |
| 9         |           |
| 21        |           |

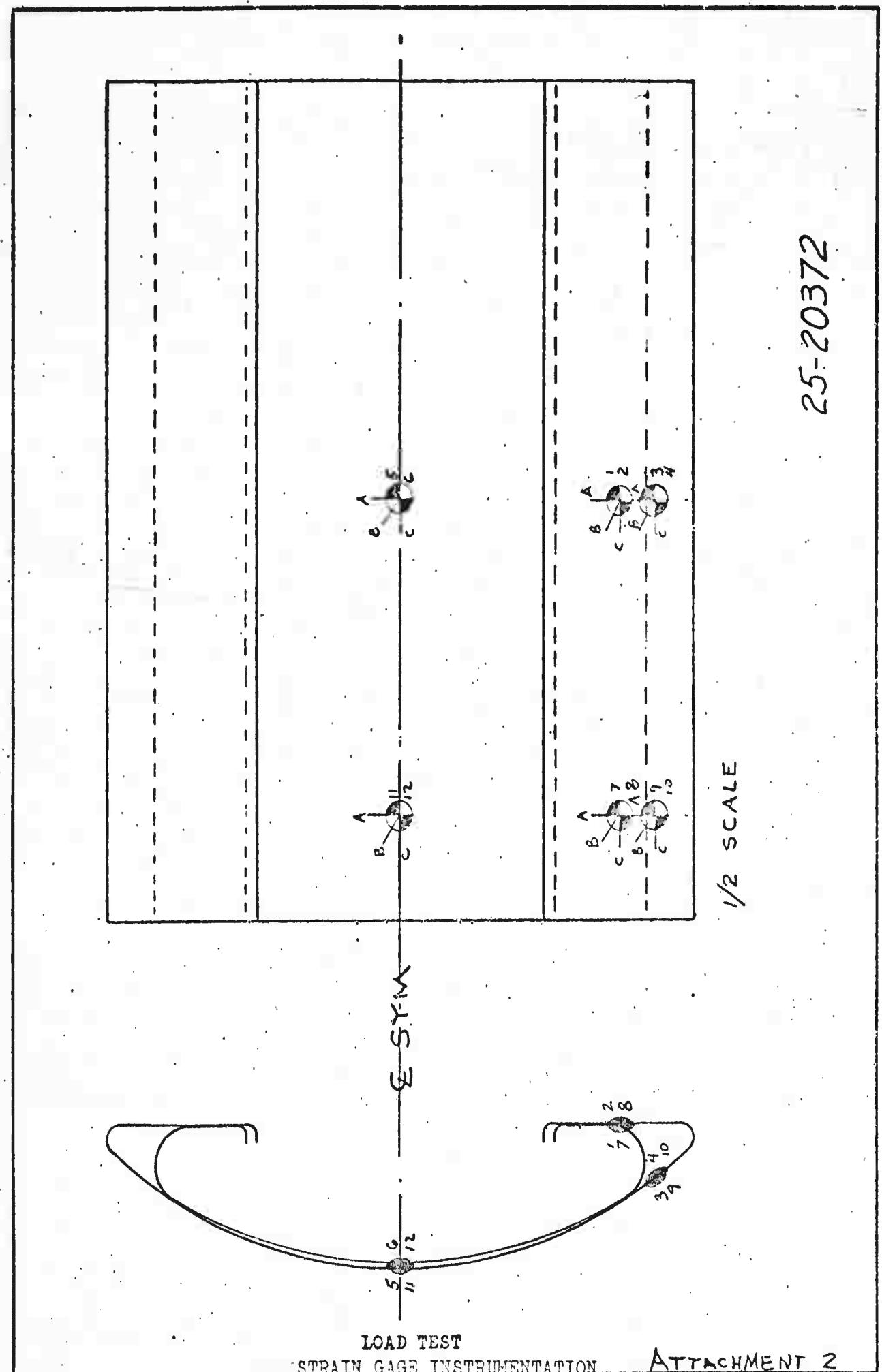


PHOTOGRAPHIC DEFLECTION  
MEASUREMENT LOCATIONS  
EWA 5-617      LT-3

2

SECTION (FULL SIZE)

FIGURE 3-17



LOAD TEST  
STRAIN GAGE INSTRUMENTATION

ATTACHMENT 2

U3-4071-1000

9-3-63

25-20372

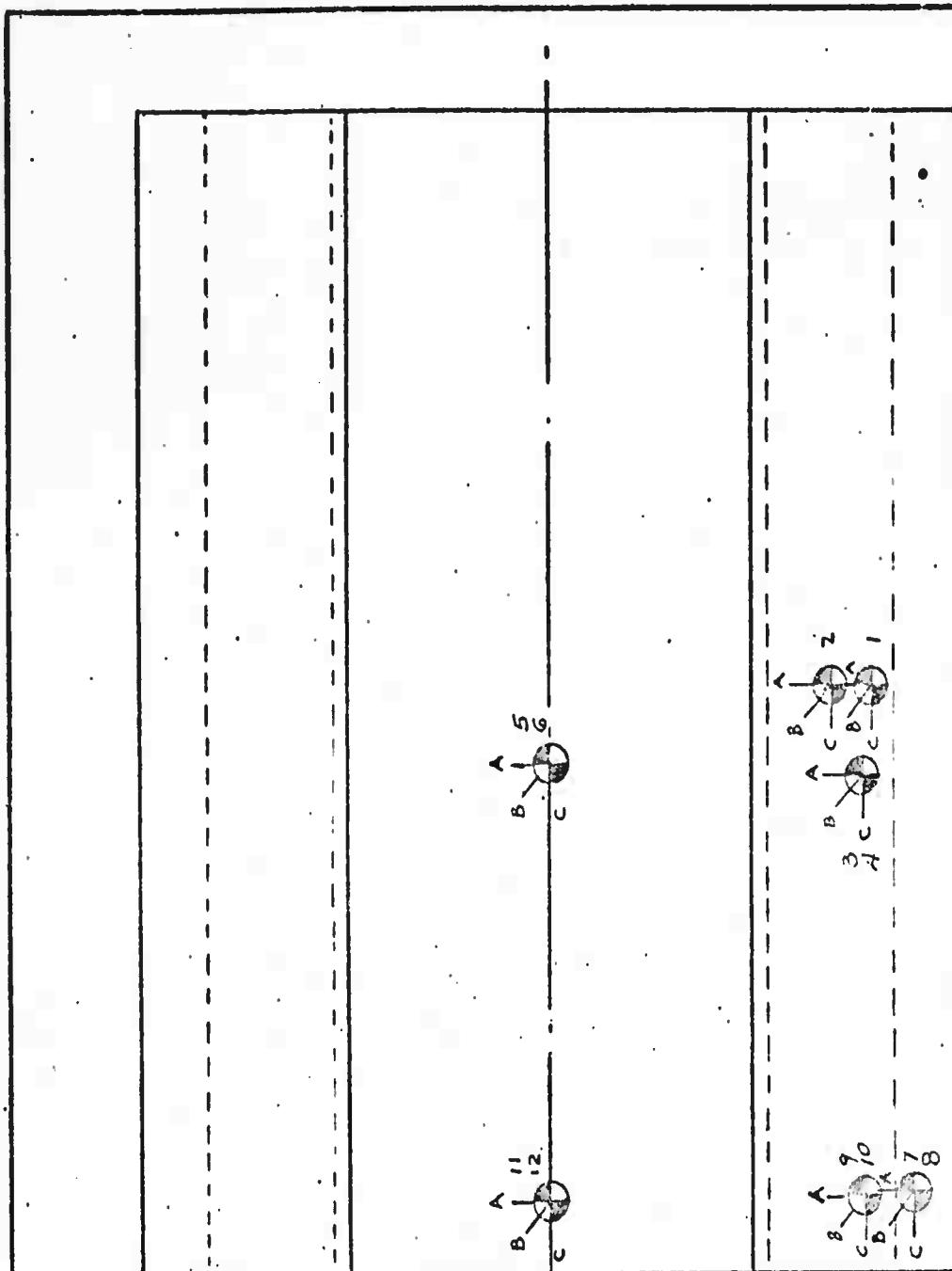
BOEING

NO. D2-80085

Volume I Sect. 3

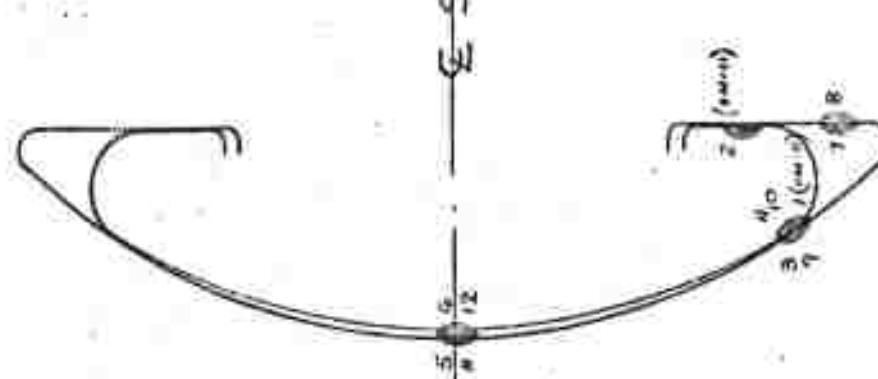
PAGE 3-36  
Fig. 3-18.

25-20372



1/2 SCALE

25-20367



LOAD TEST  
STRAIN GAGE INSTRUMENTATION

U3-4071-1000

9-3-63

25-20367

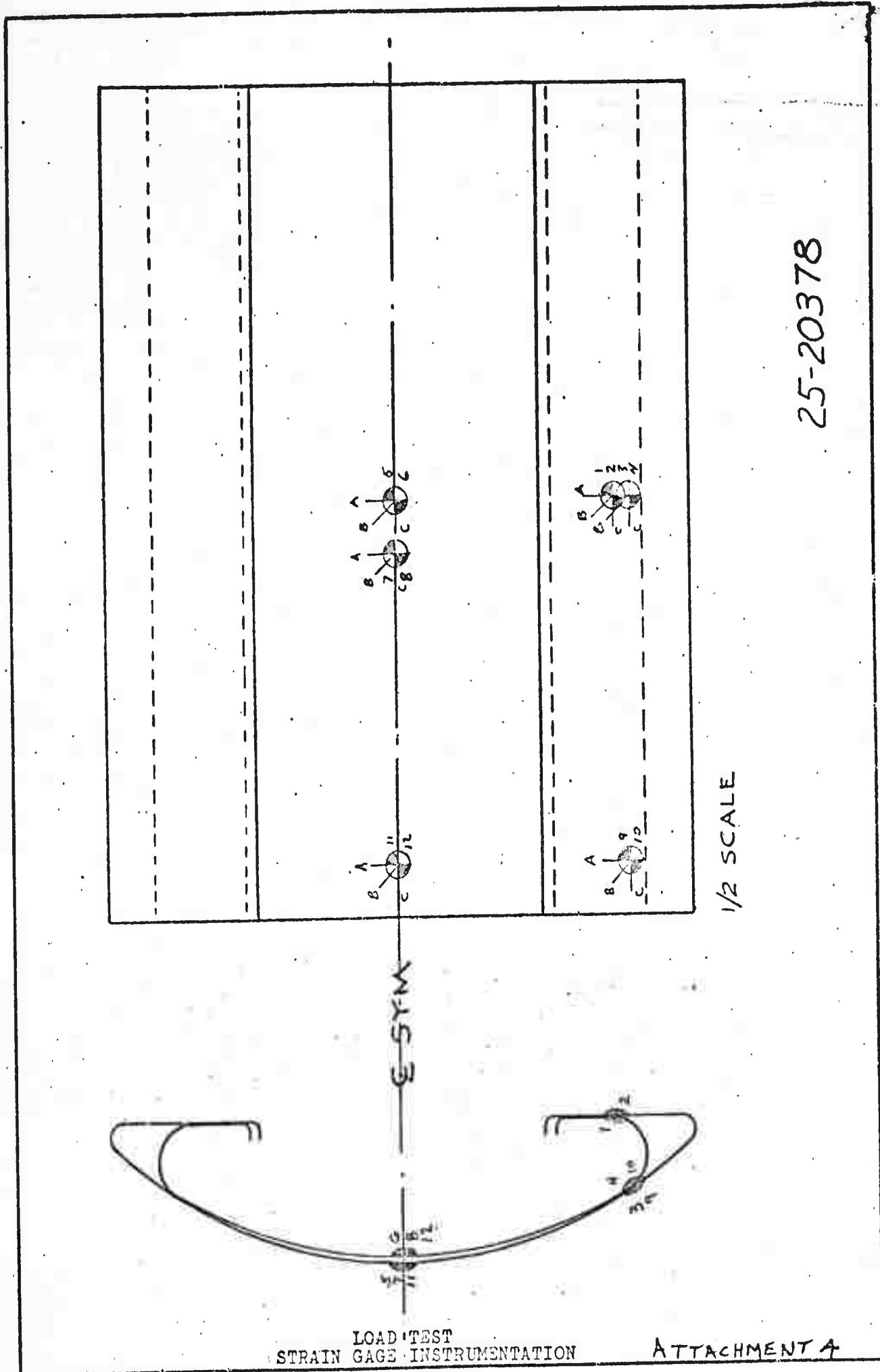
BOEING

NO. D2-80085

Sect. 3

PAGE 3-37 FIG. 3-19

Volume T



LOAD TEST  
STRAIN GAGE INSTRUMENTATION

ATTACHMENT A

US-4071-4000

9-3-63

25-20378

BOEING

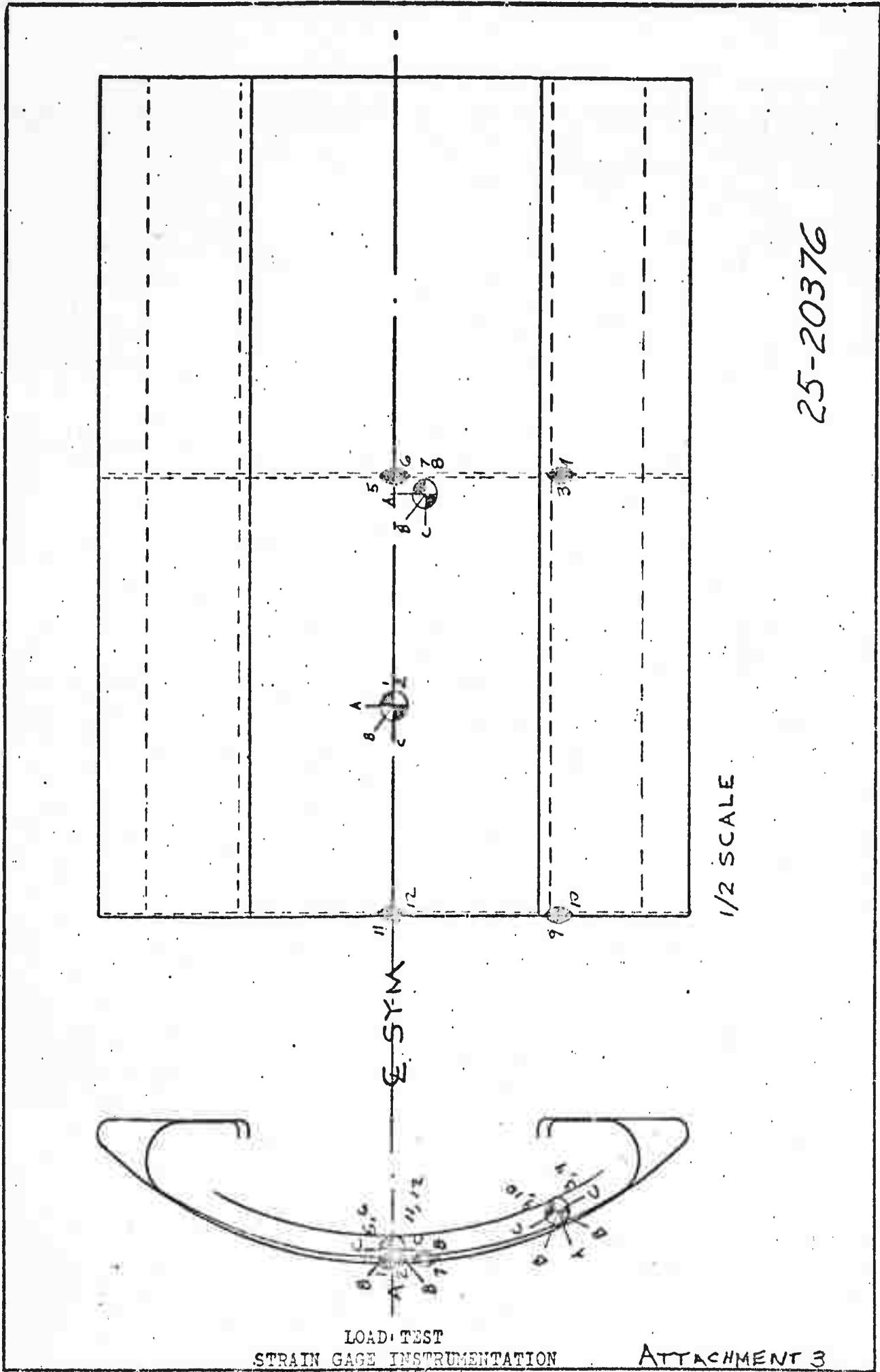
NO. D2-80085

Volume I Sect. 3

PAGE 3-20

25-20378

1/2 SCALE



U3-4071-1000

9-3-63

LOAD TEST  
STRAIN GAGE INSTRUMENTATION  
25-20376

ATTACHMENT 3

Volume I Sect. 3

BOEING

NO. D2-80085

PAGE 3-39  
Fig. 3-21.

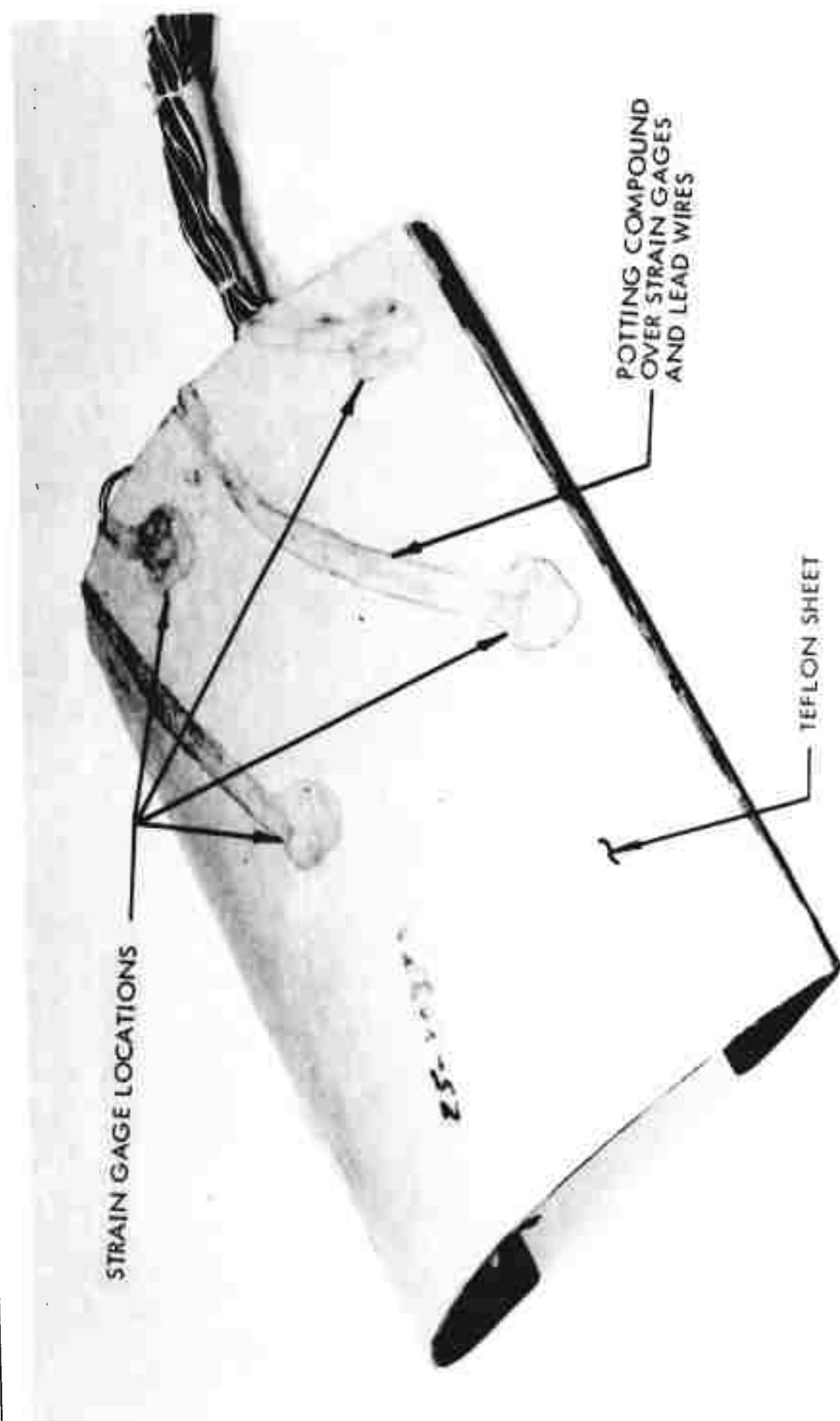
VS-1 LEADING EDGE #25-20372 BEFORE  
TESTING - TOP VIEW 1-7-62

2A95729

U3-4071-1000 (was BAC 1546-L-R3)

9-3-63

STRAIN GAGE INSTRUMENTATION  
25-20372-I BEFORE LOAD TEST



See Fig. 3-23 for  
Bottom View

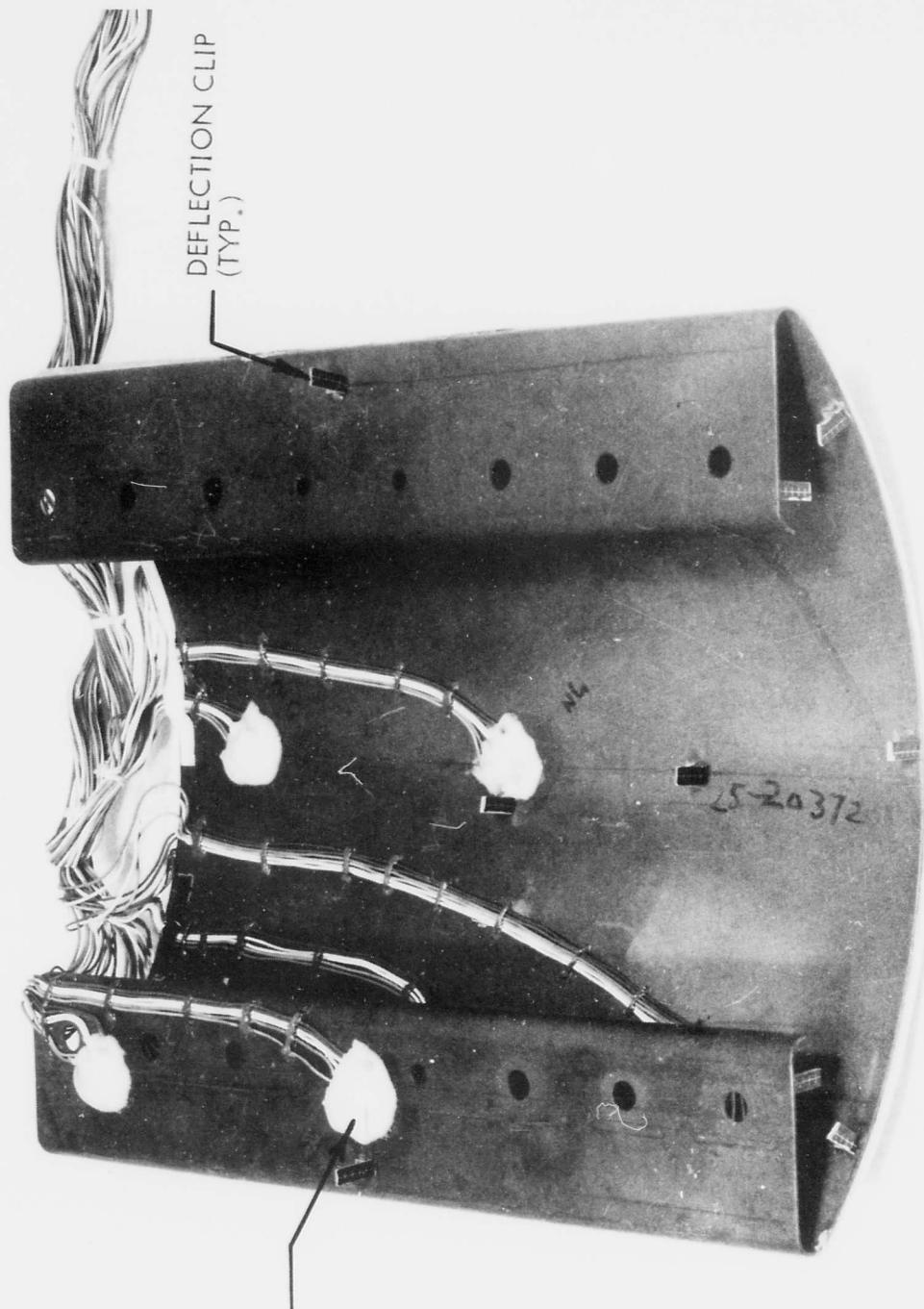
BOEING

Fig. 3-22

NO. D2-80085

PAGE 3-40





STRAIN GAGE  
ROSETTE (TYP.)

25-20372-1 BEFORE LOAD TEST

U3-4071-1000 (was BAC 1546-L-R3)

9-3-63

Volume I

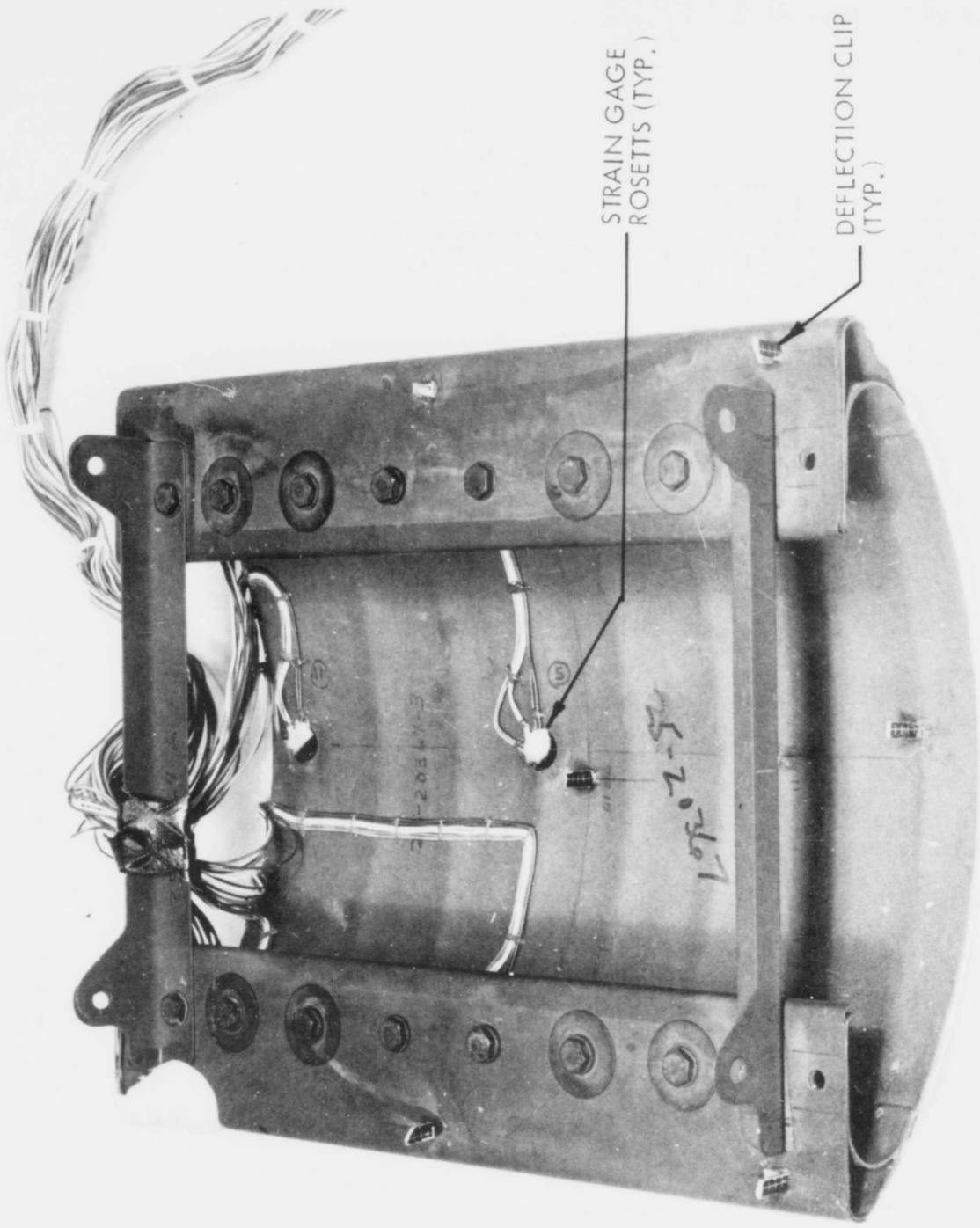
BOEING

Fig. 3-23

no. D2-80085

PAGE 3-41





25-20367-I BEFORE LOAD TEST

DS-1 LEADING EDGE #25-20367 BEFORE  
TESTING - BACK VIEW 1-7-62

2A95723

See Fig. 3-25 for  
Top View

U3-4071-1000 (was BAC 1546-L-R3)

9-3-63

Volume I

BOEING

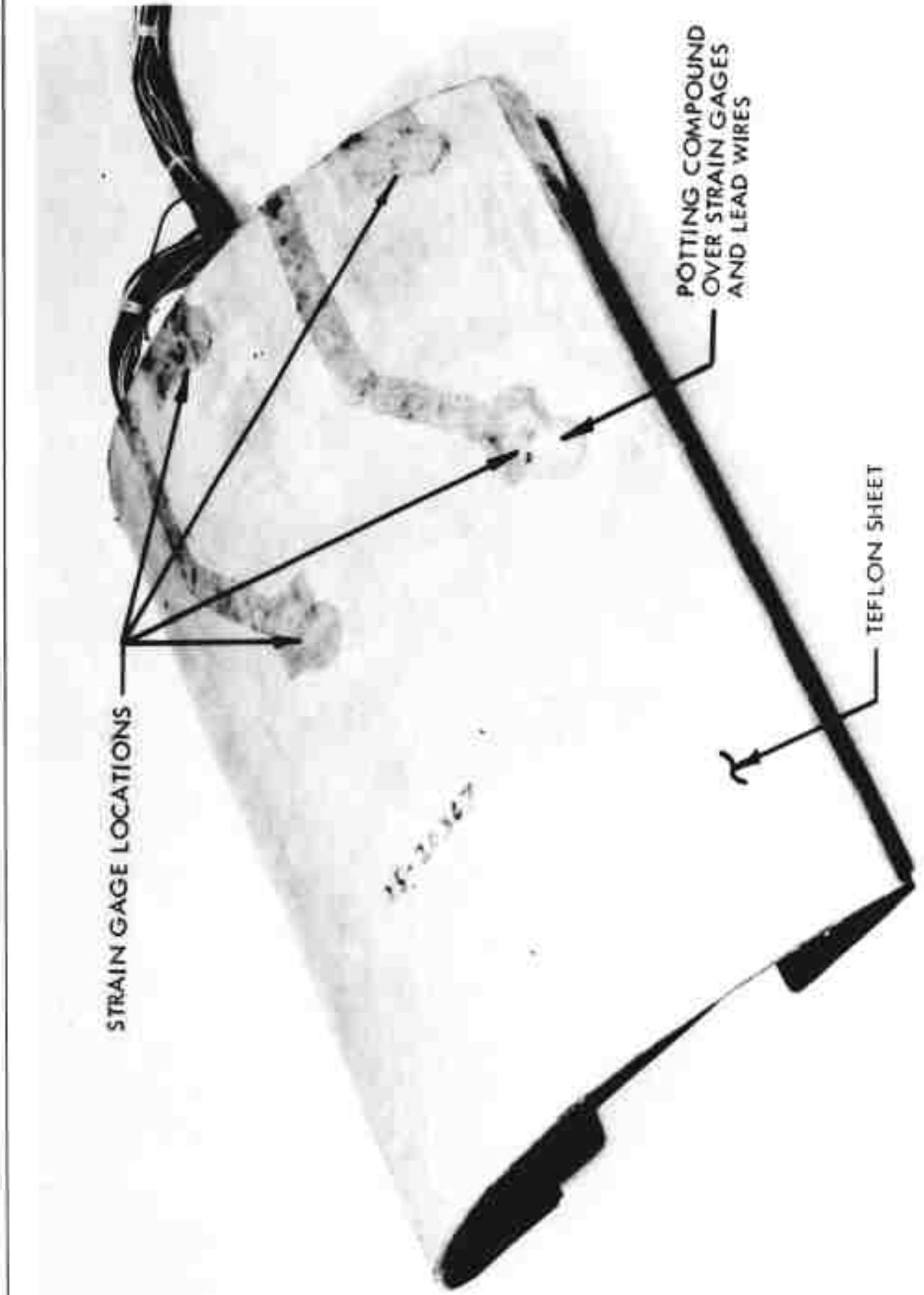
Fig. 3-24

NO. D2-80085

PAGE 3-42

DS-1 LEADING EDGE #25-20367 BEFORE  
TESTING - FRONT VIEW 1-7-62

2A95724



25-20367-1 BEFORE TEST

U3-4071-1000 (was BAC 1546-L-R3)

NO. D2-80085

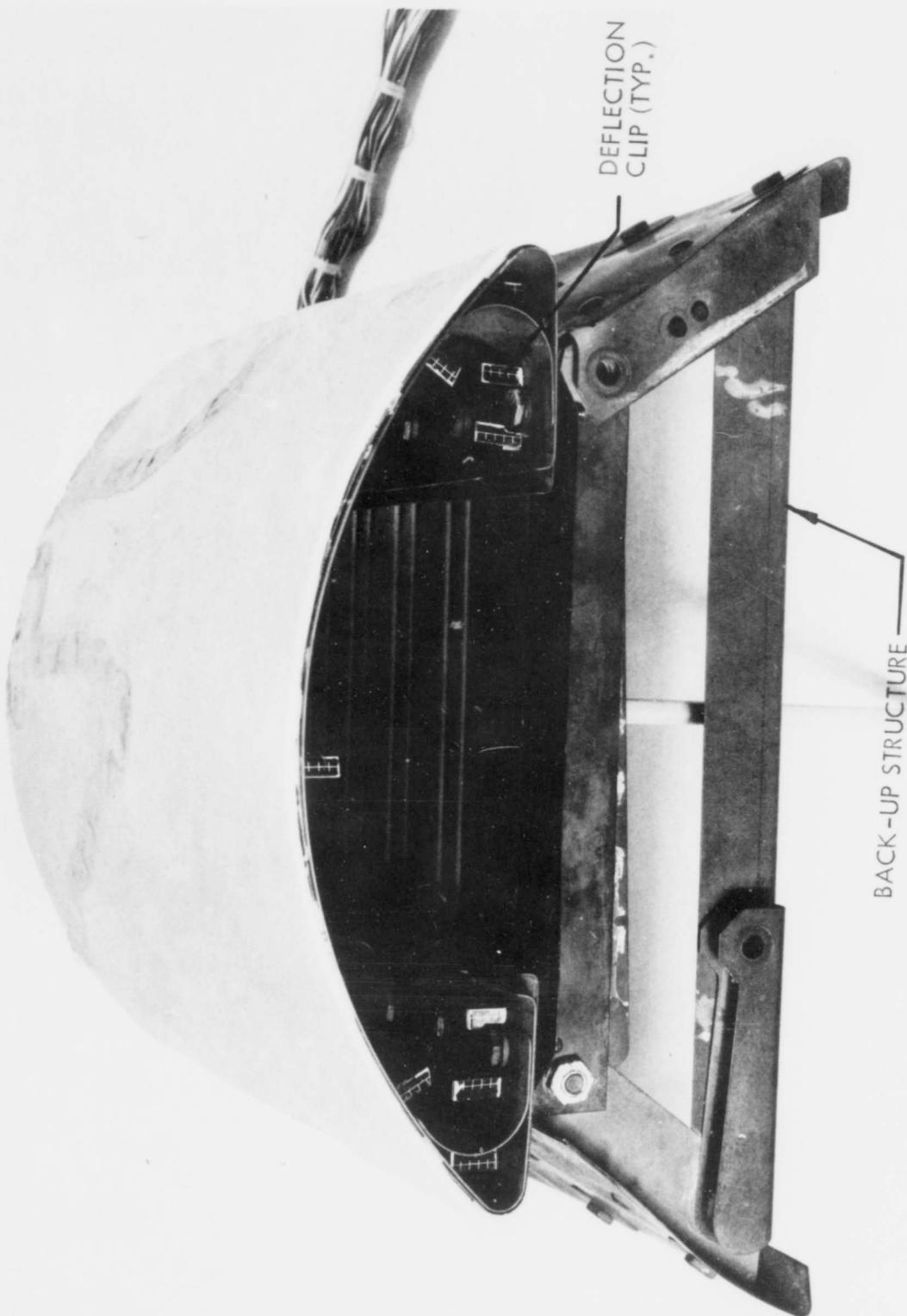
**BOEING**

Volume I

Fig. 3-25

PAGE 3-43





25-20378 BEFORE LOAD TEST

U3-4071-1000 (was BAC 1546-L-R3)

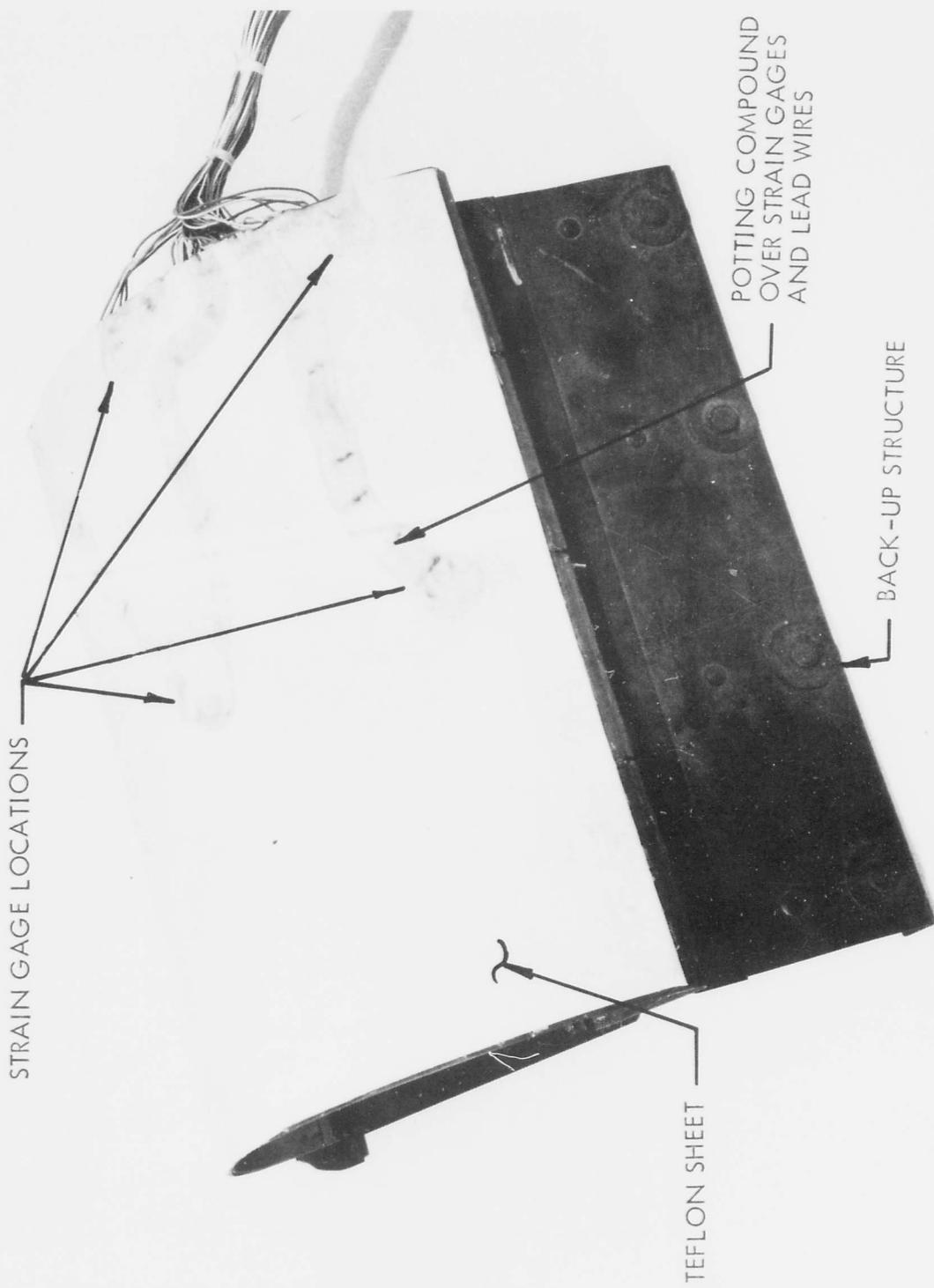
43-20378  
**BOEING**

NO. D2-80085

Volume I Fig. 3-26

PAGE 3-44





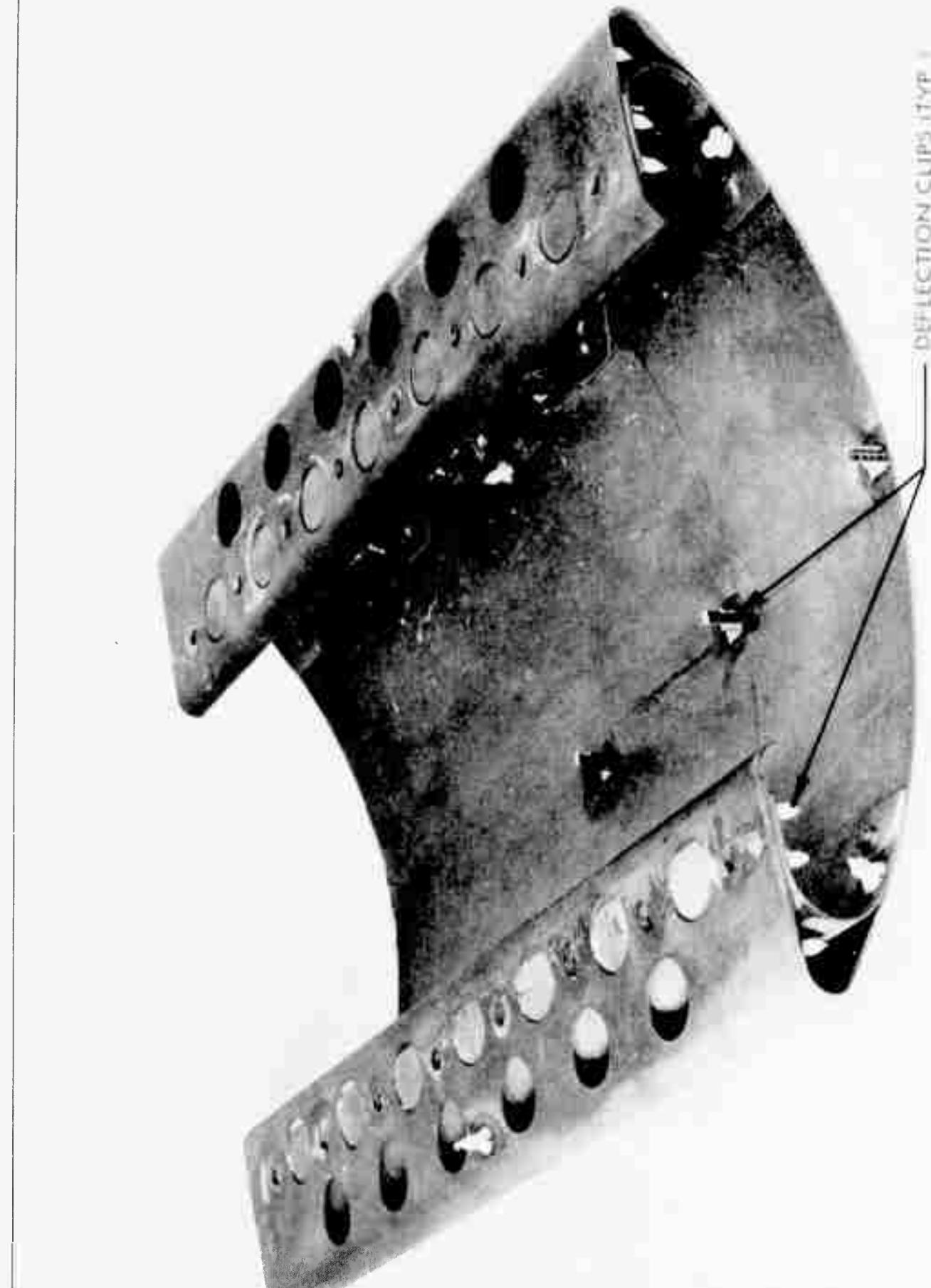
25-20378 BEFORE LOAD TEST

U3-4071-1000 (was BAC 1546-L-R3)

9303

BOEING | NO. D2-80085  
Fig. 3-27 | PAGE 3-45





25-20341- BEFORE LOAD TEST

U3-4071-1000 (was BAC 1546-L-R3)

BOEING

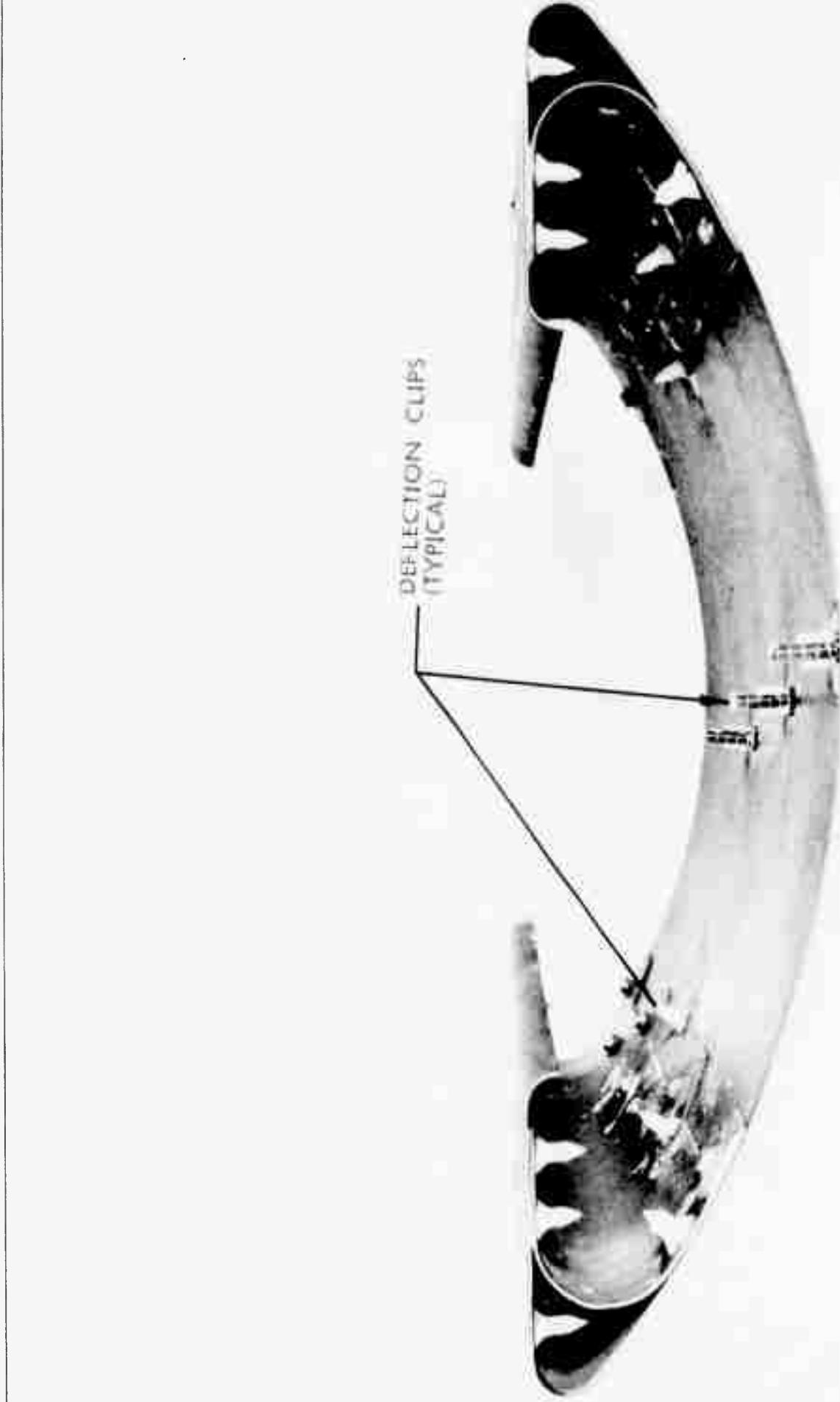
NOD2-80085

Volume I

Fig. 3-23

PAGE 3-46





25-20341-1 B: F. 1 L. AND TEST

U3-4071-1000 (was BAC 1546-L-R3)

NO. D2-80085

BOEING

Volume I

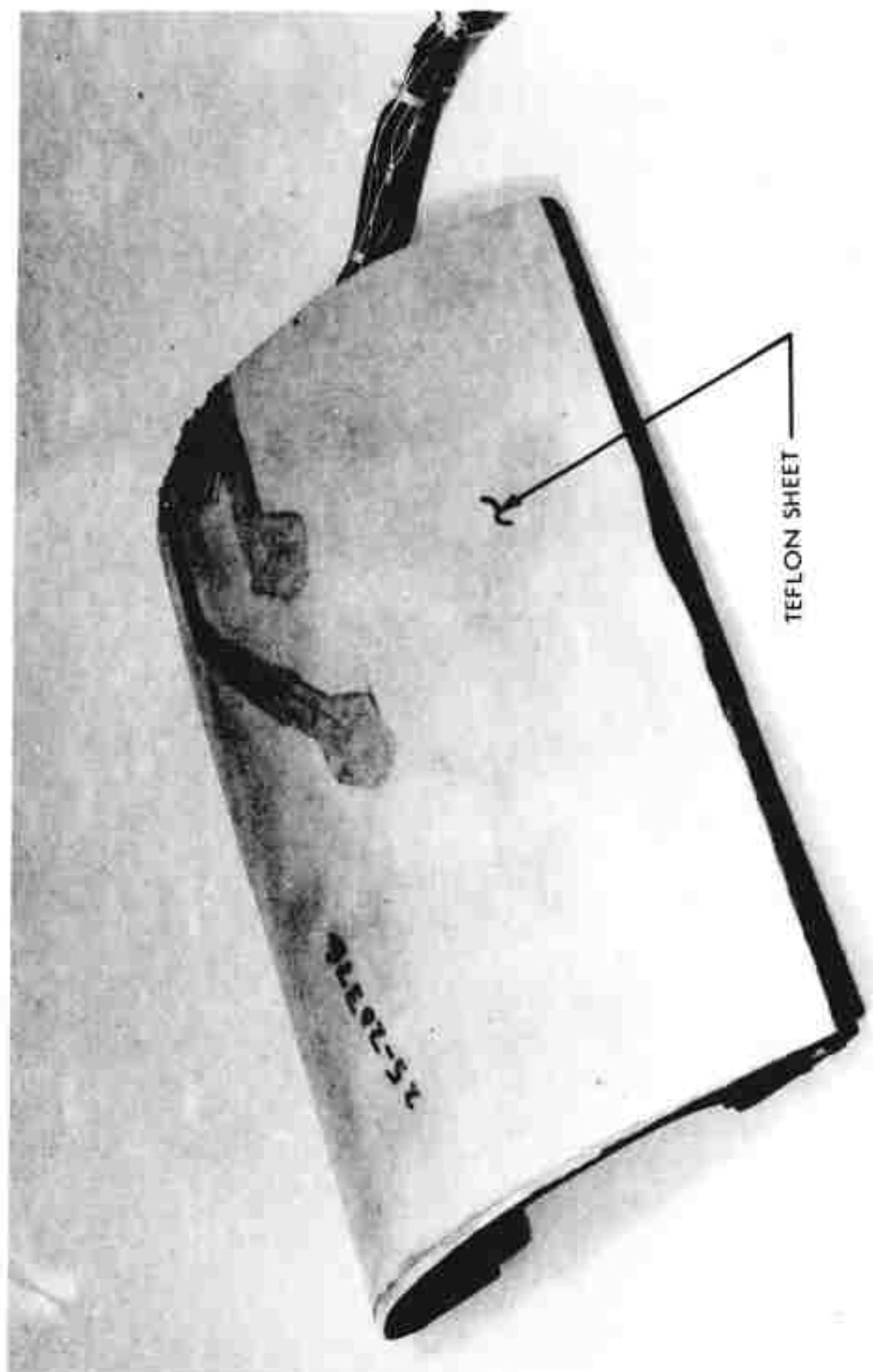
Fig. 3-29

PAGE 3-4



DS-1 LEADING EDGE #25-20376 BEFORE  
TESTING - TOP VIEW 1-7-62

2495728



25-20376-1 BEFORE TEST

U3-4071-1000 (was BAC 1546-L-R3)

BOEING

NO. D2-50085

Volume I

Fig. 3-30

PAGE 3-4





25-20376-I BEFORE TEST

U3-4071-1000 (was BAC 1546-L-R3)

9-2-63

Volume I

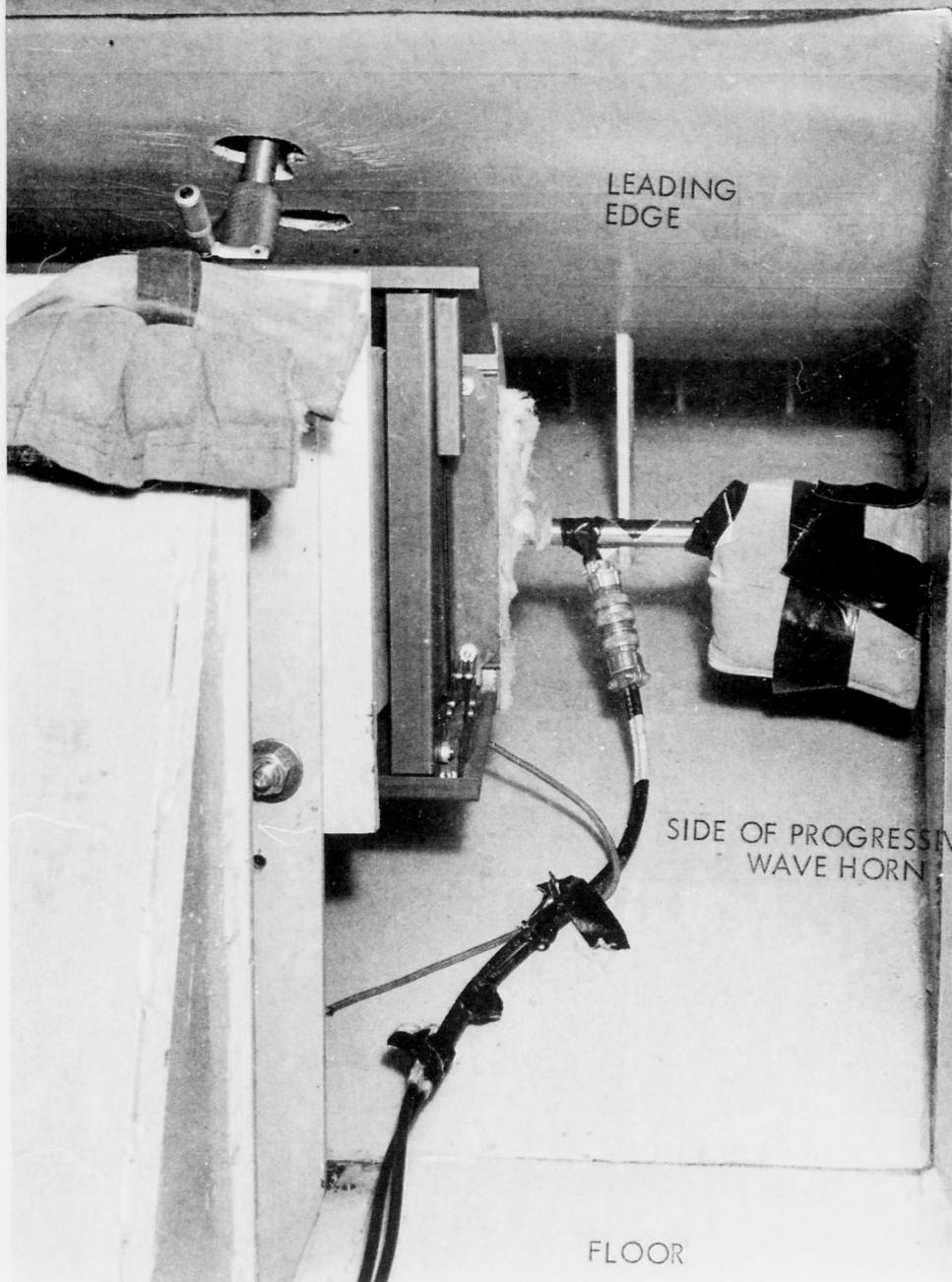
BOEING

Fig. 3-31

NO. D2-80085

PAGE 3-42





LEADING EDGE POSITIONED IN PROGRESSIVE  
WAVE HORN FOR SONIC TEST

U3-4071-1000 (was BAC 1546-L-R3)

NO. D2- 00

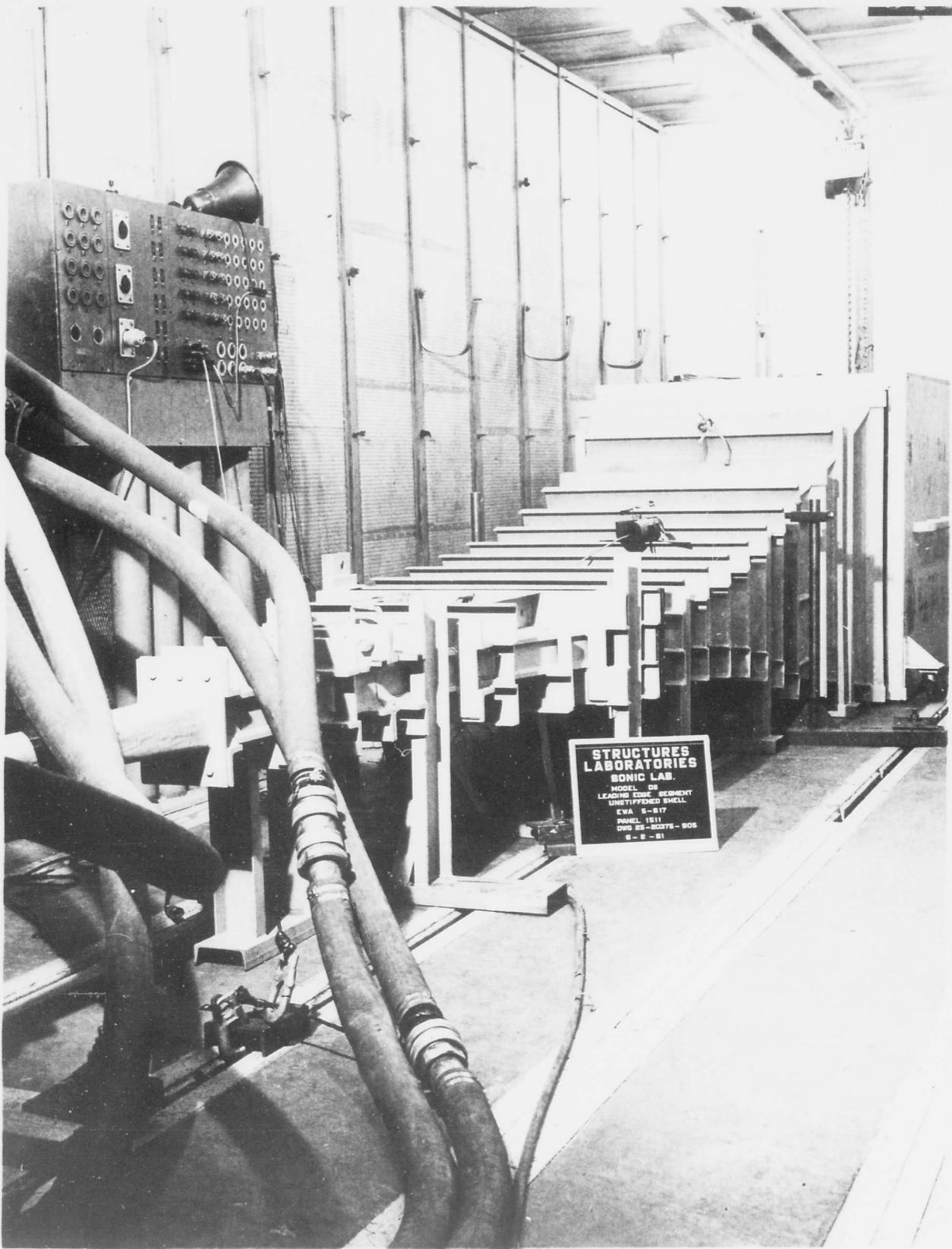
Volume 1

BOEING

Fig. 3-32

PAGE 3-50





PROGRESSIVE WAVE HORN

U3-4071-1000 (was BAC 1546-L-R3)

93-03

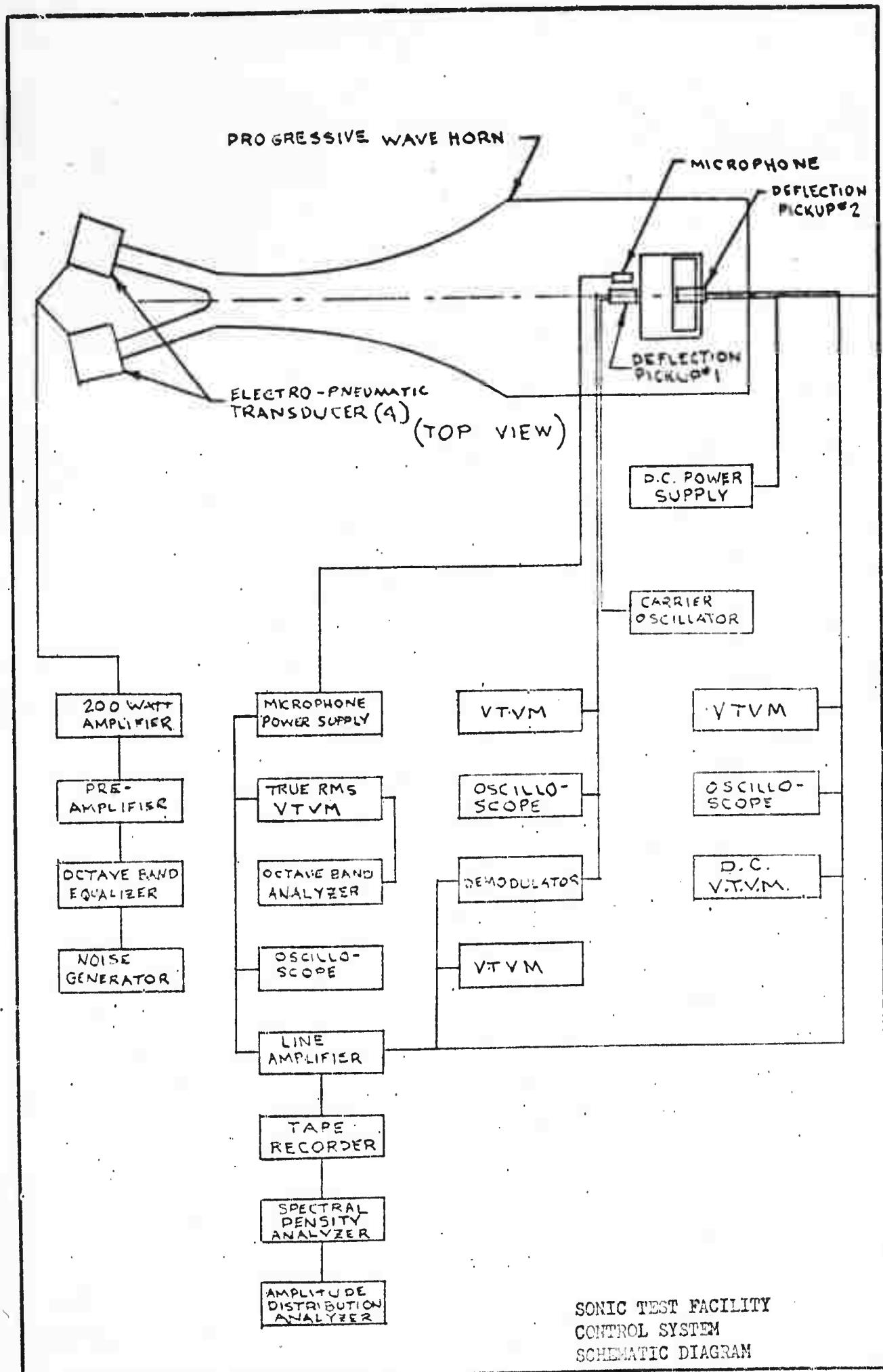
BOEING

NO. D2-5007

Volume I Fig. 3-33

PAGE 3-51





U3-4371-1000

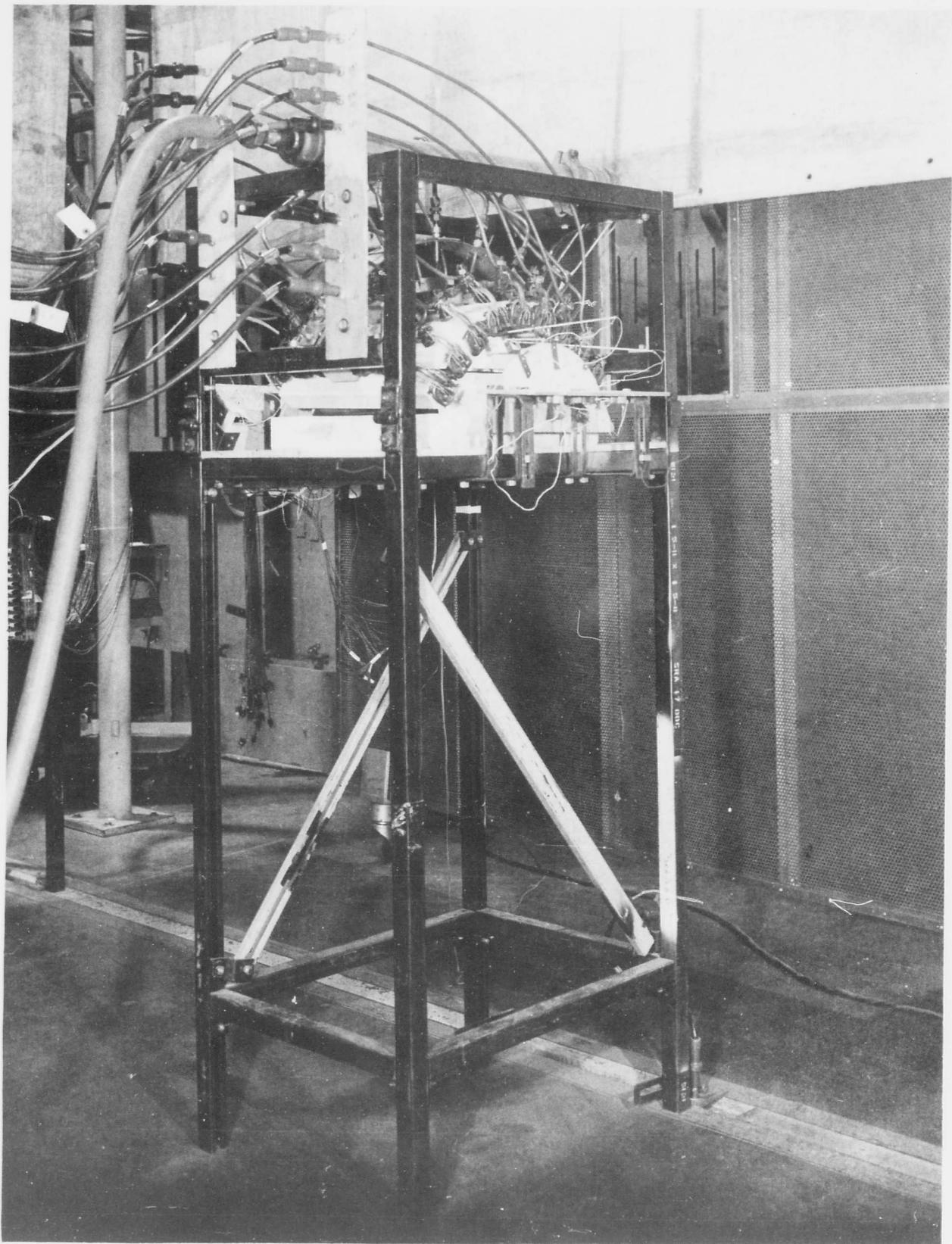
9-3-63

SONIC TEST FACILITY  
CONTROL SYSTEM  
SCHEMATIC DIAGRAM

**BOEING**

NO. D2-80085

PAGE Fig. 3-34  
3-52



THERMAL GRADIENT TEST FIXTURE

U3-4071-1000 (was BAC 1546-L-R3)

9-3-63

BOEING

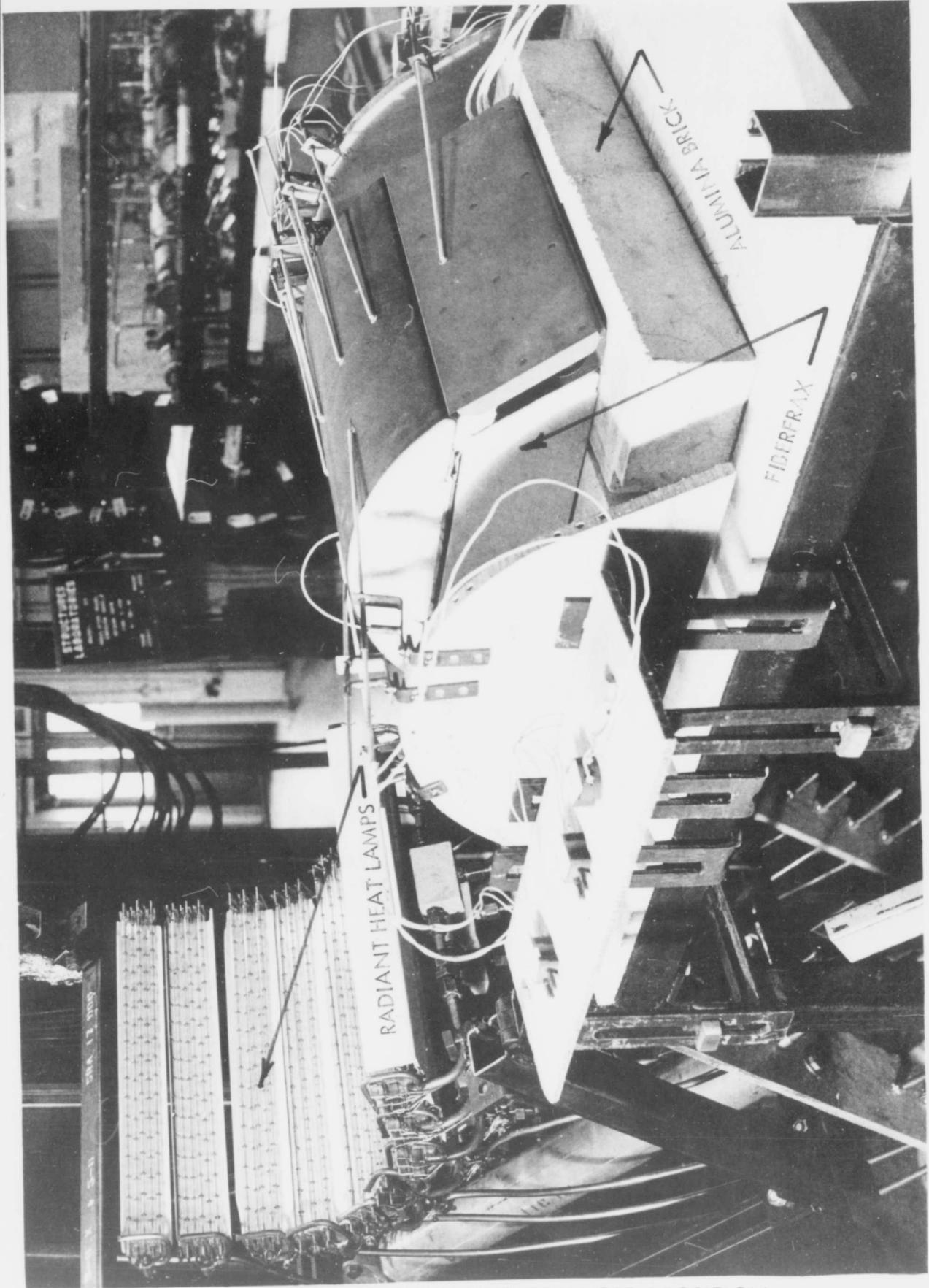
NO D2-0045

Volume I

Fig. 3-35.

PAGE 3-53





Thermal Gradient Test Fixture in Open Position

U3-4071-1000 (was BAC 1546-L-R3)

9-3-63

Volume I

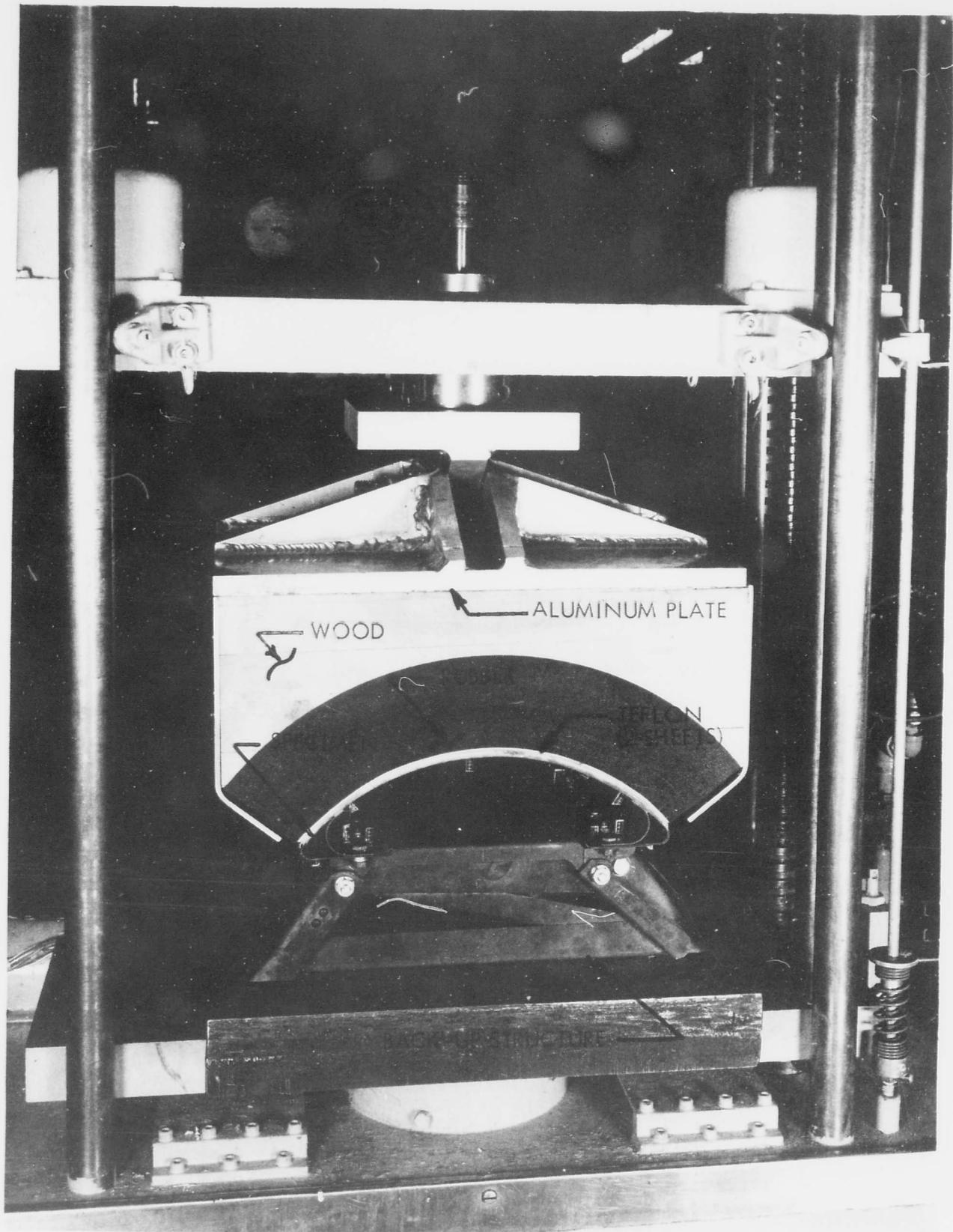
BOEING

NO. D2-00035

Fig. 3-36

PAGE 3-54





LOAD TEST FIXTURE

U3-4071-1000 (was BAC 1546-L-R3)

9363

NO. D2-80085

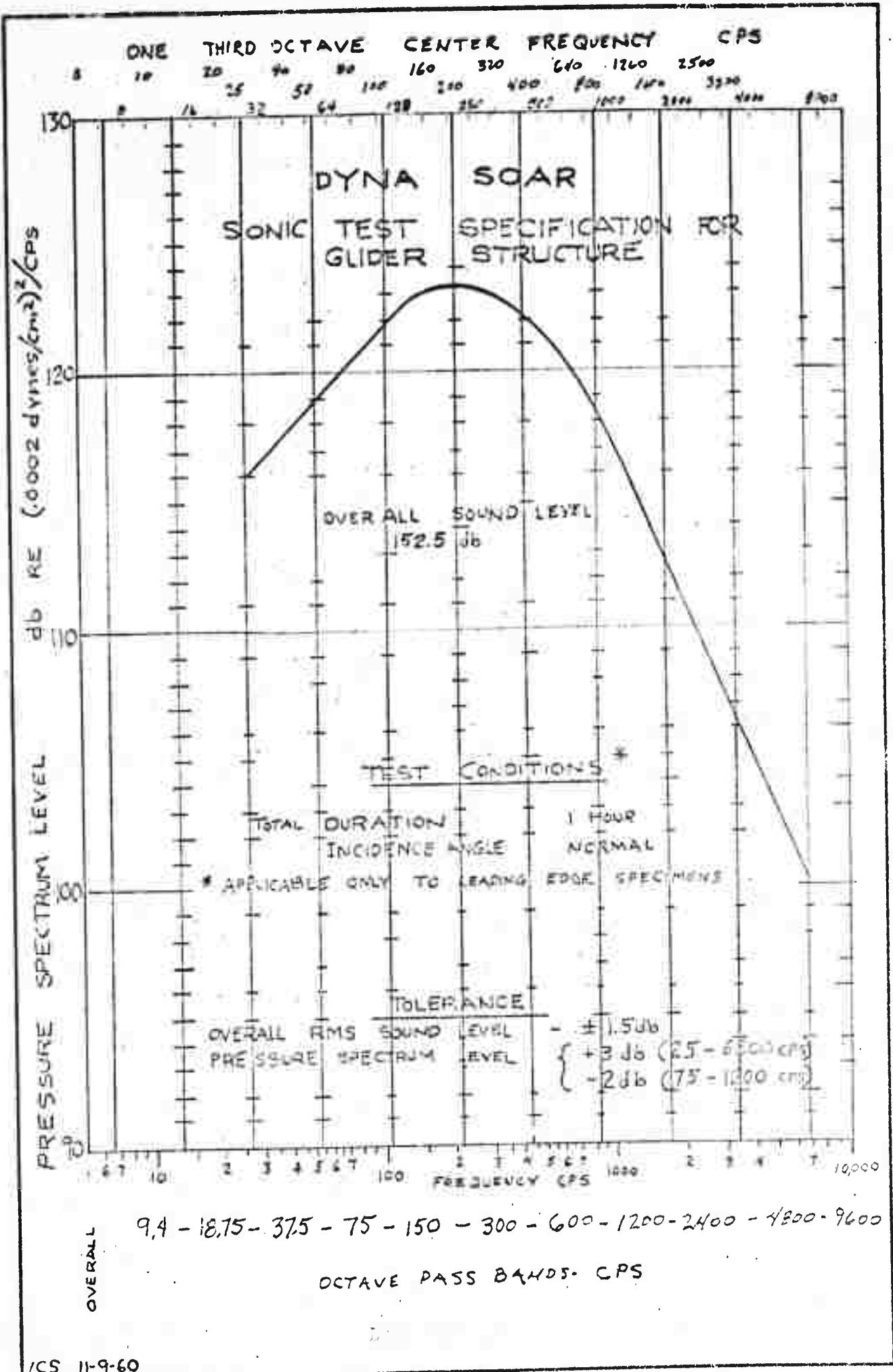
BOEING

Volume I

Fig. 3-37

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58

U3-471-4006

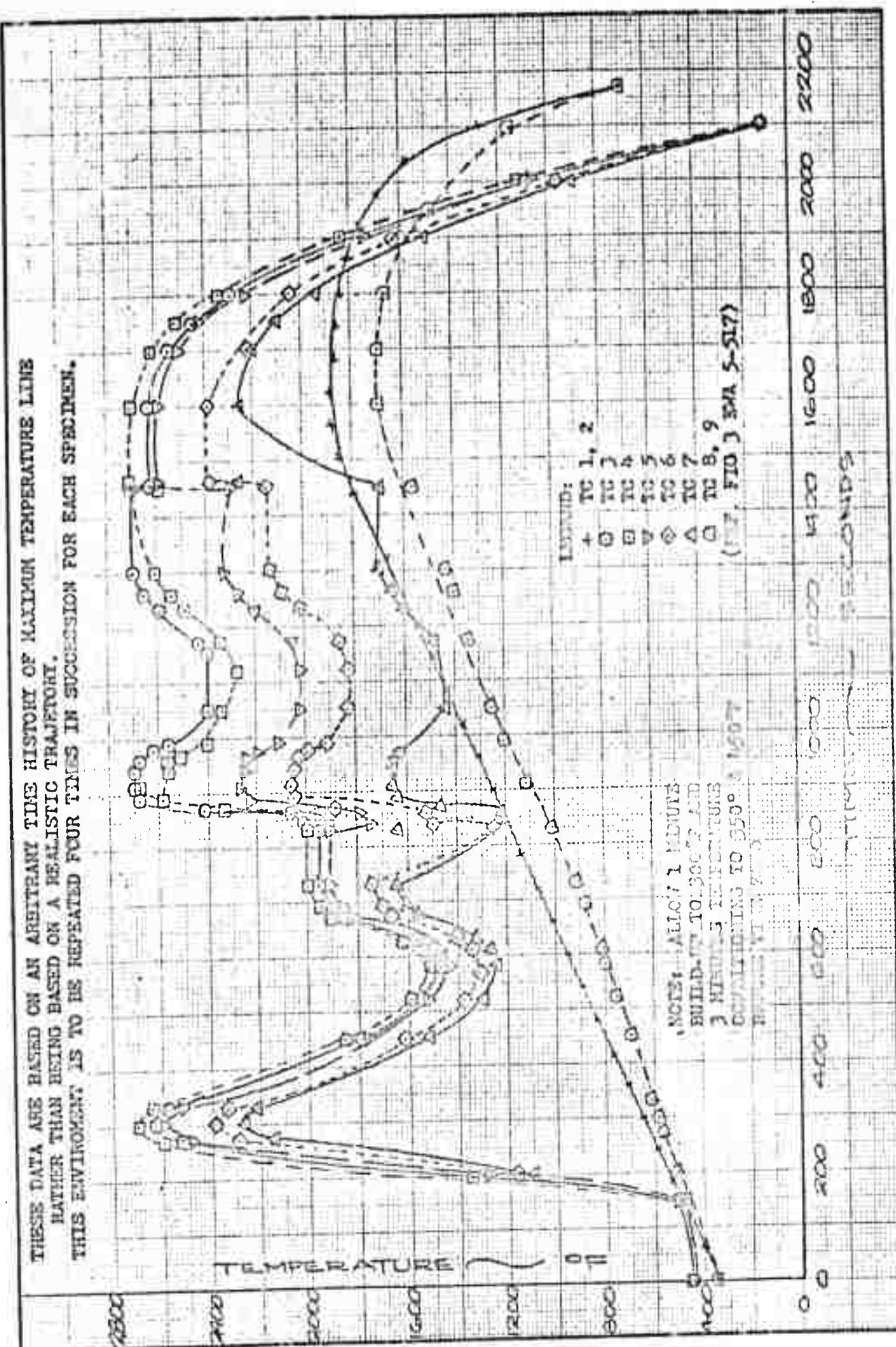
9-3-63

Volume I Sect: 3

NO. D2-80085

PAGE Fig. 3-38

THESE DATA ARE BASED ON AN ARBITRARY TIME HISTORY OF MAXIMUM TEMPERATURE LINE  
RATHER THAN BEING BASED ON A REALISTIC TRAJECTORY.  
THIS ENVIRONMENT IS TO BE REPEATED FOUR TIMES IN SUCCESSION FOR EACH SPECIMEN.



US-4071-1000

9-3-63

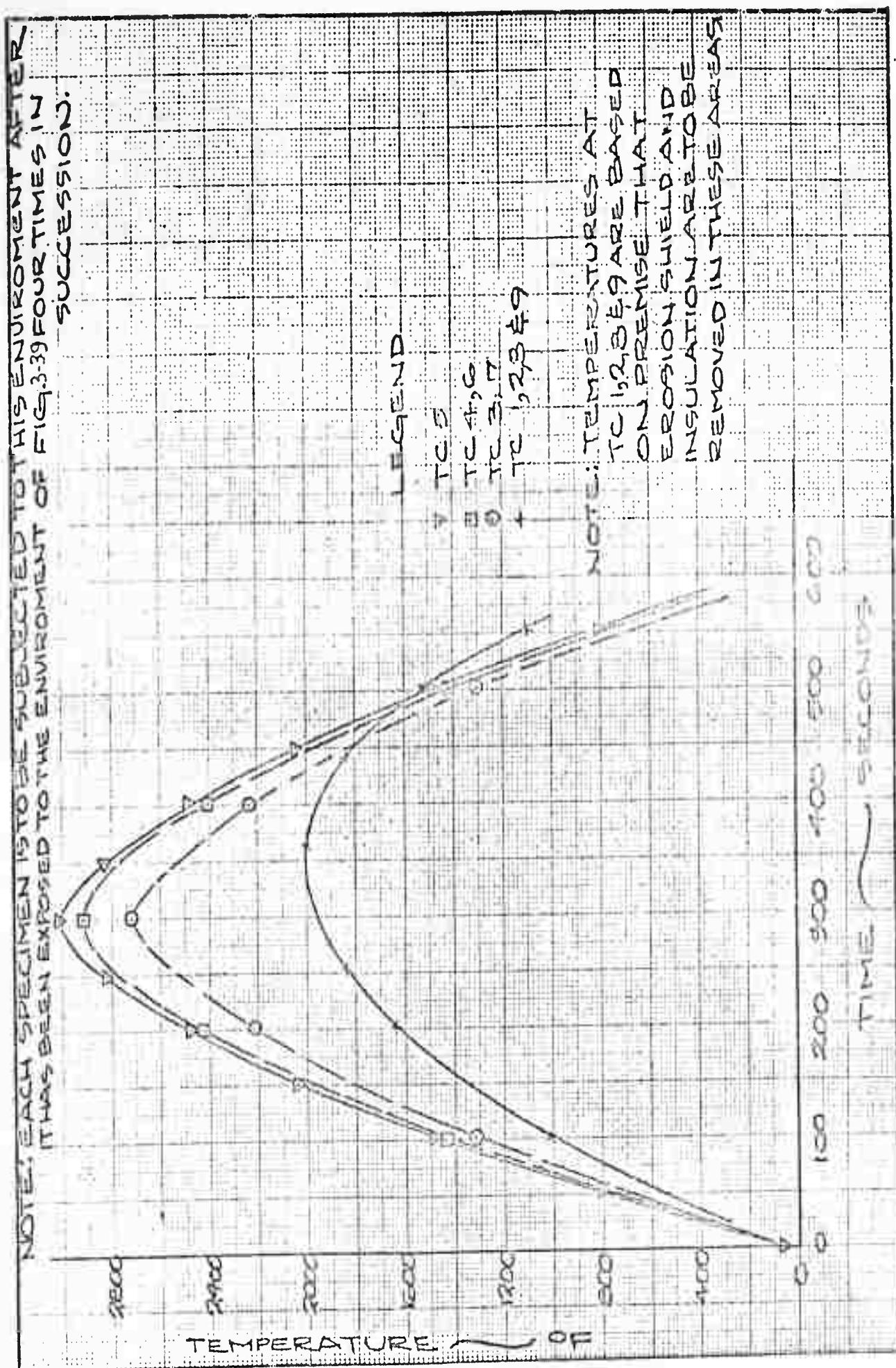
Thermal Gradient Test Program  
(Maneuver Cycle)

BOEING

NO. D2-80085

PAGE 1  
3-57 FIG. 3-39

Volume I Sect. 3



103-4771-1004

THERMAL GRADIENT TEST PROGRAM  
9-3-63 (TRAJECTORY CYCLE) (1-1)

60

Volume I

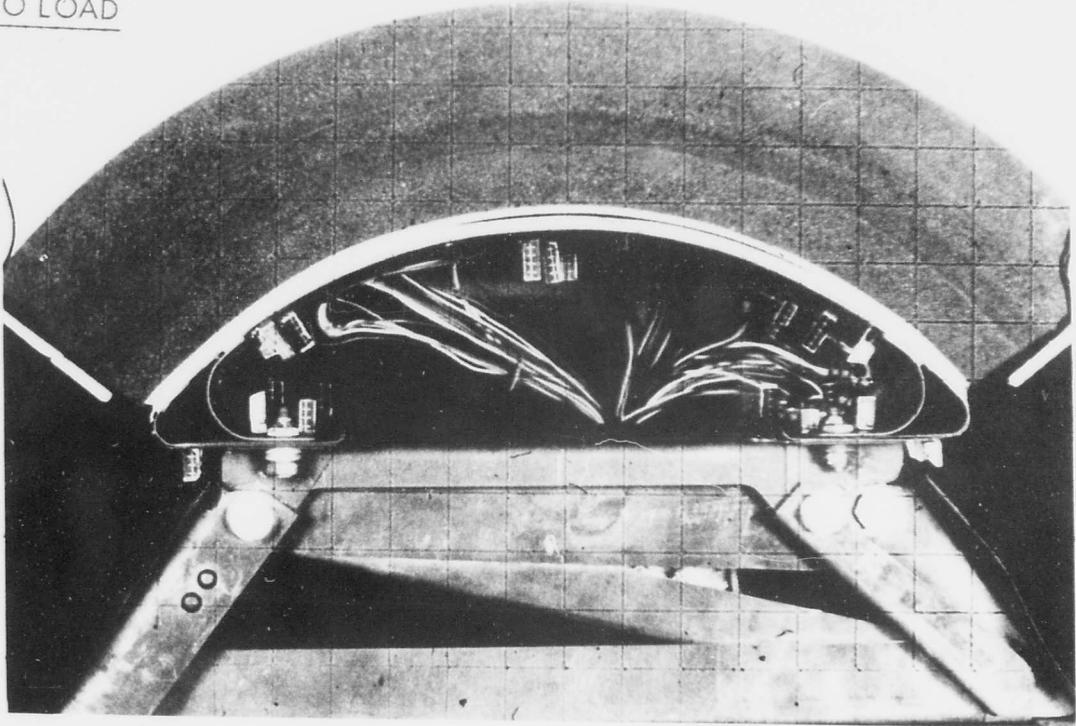
BOEING

Sect. 3

NO. D2-80085

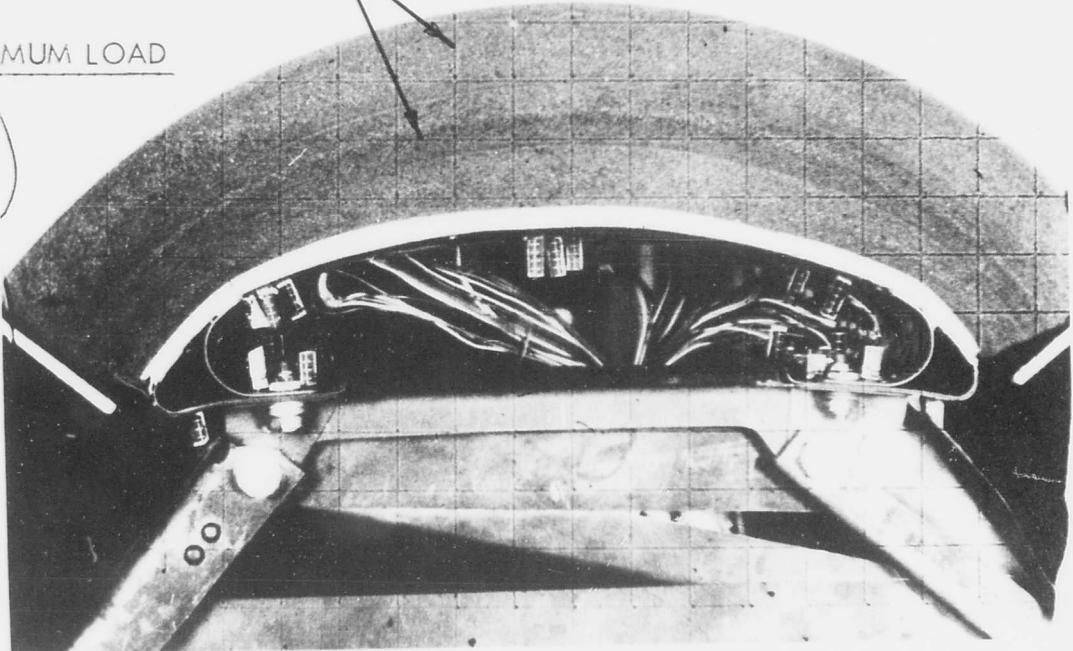
PAGE  
38 FIG. 3-49

ZERO LOAD



MAXIMUM LOAD

GRID LINES OVER LENS OF CAMERA FOR  
PHOTOGRAPHIC DEFLECTION MEASUREMENT



SPECIMEN 25-20367-I DISPLAYING TYPICAL LOAD AND  
DEFLECTION MEASUREMENT TECHNIQUE

U3-4071-1000 (was BAC 1546-L-R3)

7-3-63

BOEING

NO. D2-80085

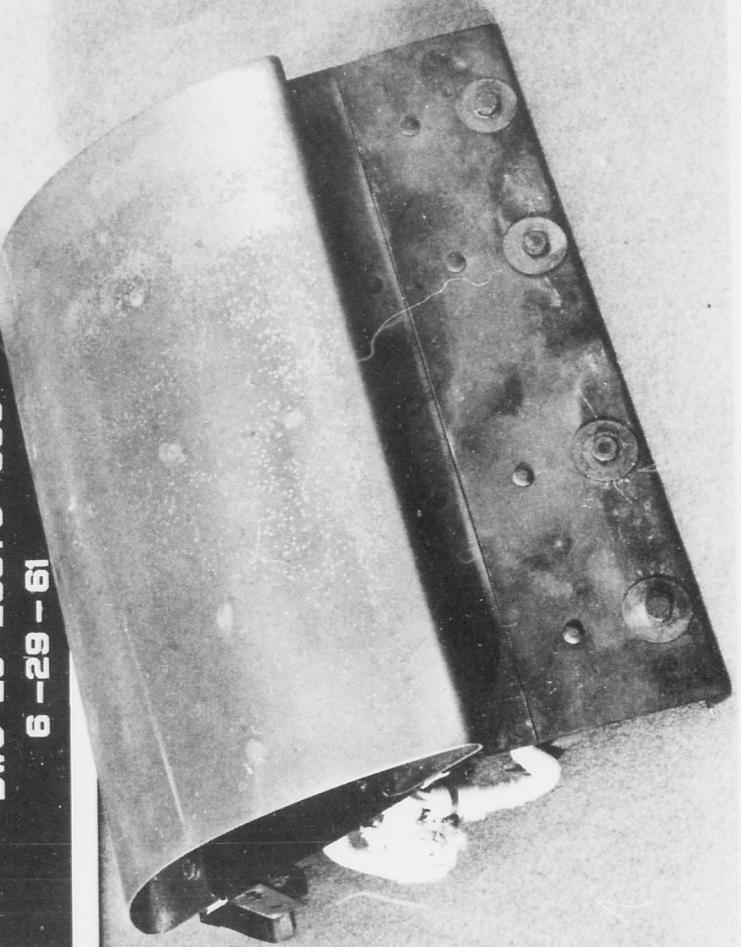
Volume I

Fig. 3-41

PAGE 3-32

STRUCTURES  
LABORATORIES  
SONIC LAB.  
DS LEADING EDGE UNSTIFF  
AFTER HEAT ENVIRON

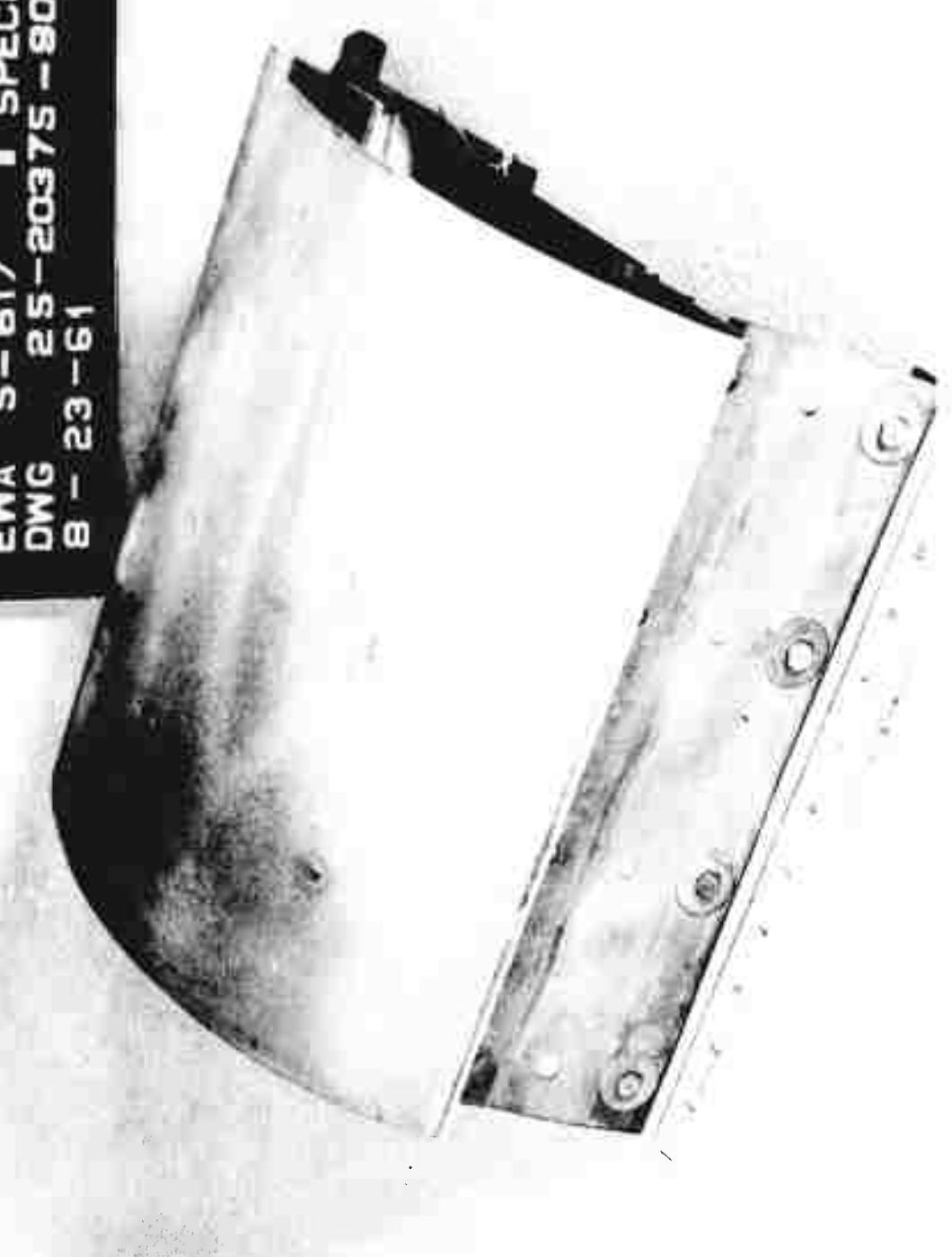
EWA 5-617  
SPECIMEN 1511  
DWG 25-20375-990  
6-29-61



25-20372-I AFTER SONIC TEST

DS-1- LEADING EDGE - SL 1517 (25-20375-905  
TOP VIEW  
LOT 2 ) 8-24-61

STRUCTURE LAB. SONIC LAB.  
MODEL - DS LEADING EDGE  
SEGMENT UNSTIFFENED SHELL  
TEST COMPLETED  
EWA 5-617 I SPECIMEN 1517  
DWG 25-20375-805 LOT 2  
8-23-61



25-20372-2 AFTER SONIC TEST

WJ34007110000 (Rev: B) M/C 159444 L/03

9-3-63

Volume I

Fig. 3-43

PAGE 3-31

McDonnell D2-50031



DS-1 REINFORCED LEADING EDGE - TEST COMPLETED 2/9/627  
EWA 5-617 #1528 25-20375-903 LOT 1 PART  
ITEM 10-13-61

STRUCTURE LAB. SONIC LAB.  
MODEL - DS  
LEADING EDGE SEGMENT REINFORCED  
TEST COMPLETED  
DWG 25-20375-903 LOT 1  
EWA 5-617 SPECIMEN 1528  
OCT 12 - 61



25-20367-1 AFTER SONIC TEST

U3-4071-1000 (was BAC 1546-L-R3)

9-3-63

BOEING

NO. D2-30085

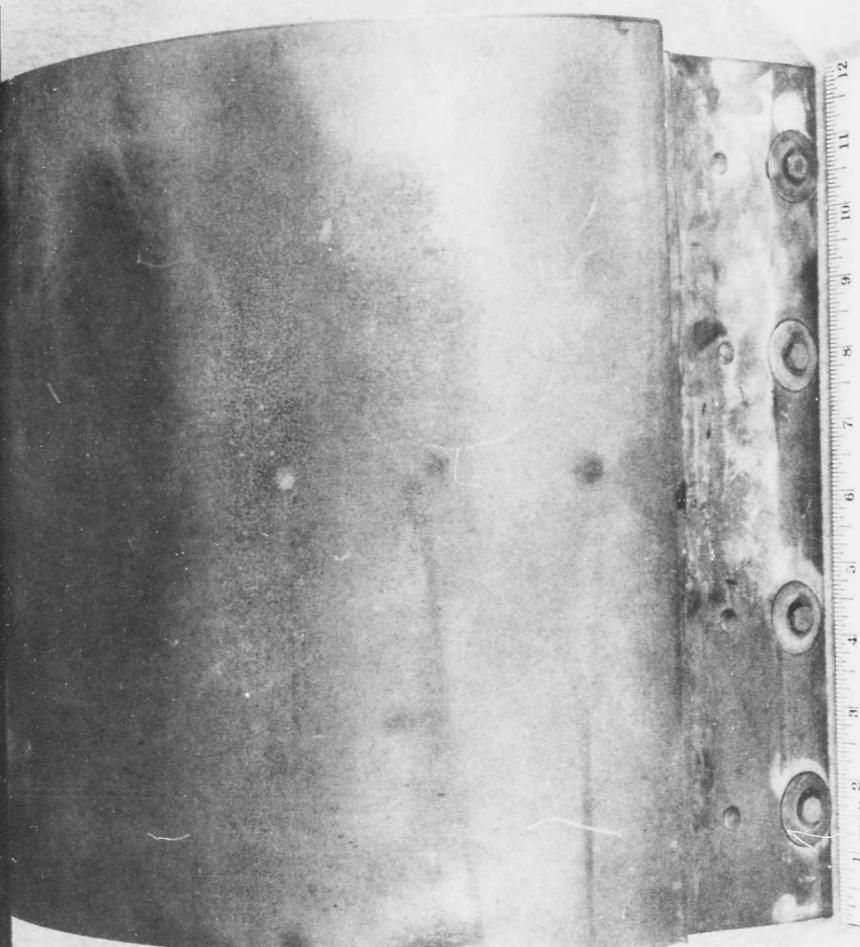
Volume I

Fig. 3-44

PAGE 5-52



STRUCTURE LAB SONIC LAB  
MODEL DS LEADING EDGE  
SEGMENT - DOUBLE SKIN  
TEST COMPLETED  
DWG 25 - 20375 - 903 LOT 2  
EWA 5 - 617 SPECIMEN 1531  
OCT 12 - 61



25-20375-2 AFTER SONIC TEST

U3-4071-1000 (was BAC 1546-L-R3)

93-13

BOEING

NO. D2-1000

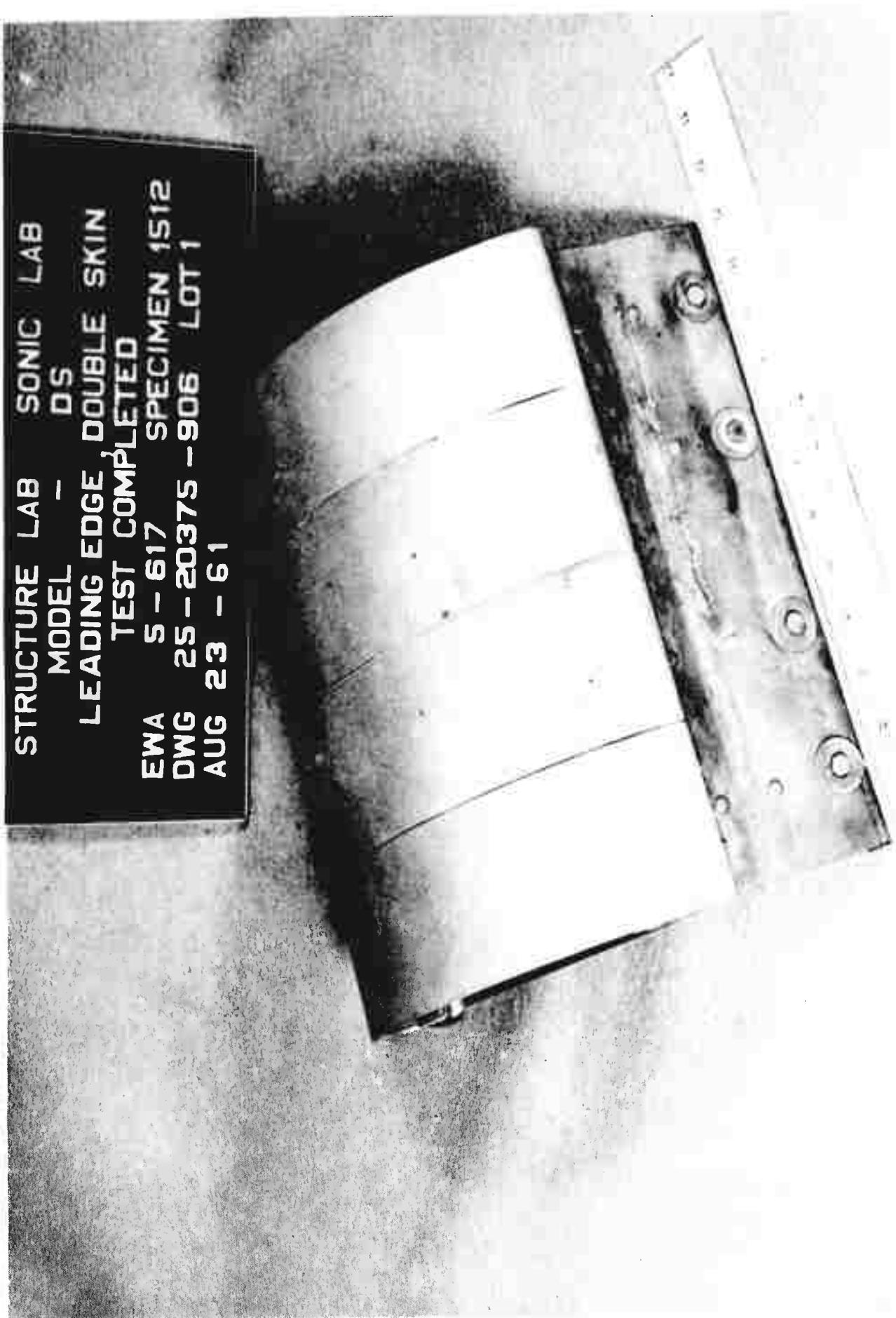
Fig. 3-45

PAGE 3-68



DS-1-LEADING EDGE - SL 1512 (25-20375-906  
LOT 1) TOP VIEW 2487157

STRUCTURE LAB SONIC LAB  
MODEL - DS  
LEADING EDGE DOUBLE SKIN  
TEST COMPLETED  
EWA 5 - 617 SPECIMEN 1512  
DWG 25 - 20375 - 906 LOT 1  
AUG 23 - 61



25-20378-1 AFTER SONIC TEST

U3-4071-1000 (was BAC 1546-L-R3)

9-3-63

BOEING

NO. D2-90085

Fig. 3-46

PAGE 3-4

10/10/10 I





25-20378-2 AFTER SONIC TEST

DS-1 LEADING EDGE DOUBLE SKIN AFTER SONIC  
ENVIRON. CLOSE UP SPEC. #1518 7-21-61

2A87562

U3-4071-1000 (was BAC 1546-L-R3)

9.3.63

NO. D2-80085

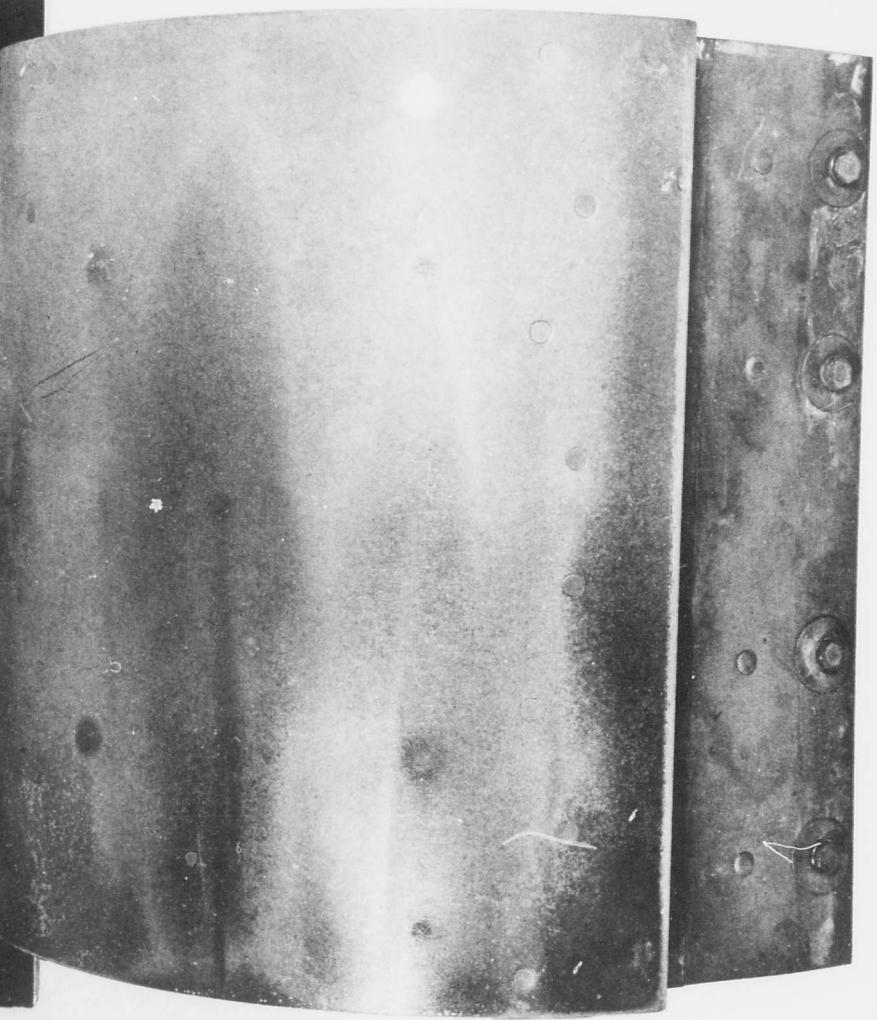
BOEING

Y. 1111. I. Fig. 3-47

PAGE 3-55



STRUCTURE LAB SONIC LAB  
MODEL - DS  
LEADING EDGE, UNSTIFF SHELL  
TEST COMPLETED  
5-617 SPECIMEN 1522  
EWA 25-20375-1 LOT 1  
DWG 7-61  
SEPT



25-20341-1 AFTER SONIC TEST

U3-4071-1000 (was BAC 1546-L-R3)

9-3-63

BOEING NO. D2-80035  
Fig. 3-48 PAGE 3-33



STRUCTURE LAB SONIC LAB  
MODEL DS LEADING EDGE  
SEGMENT - UNSTIFFENED  
TEST COMPLETED  
DWG 25 - 20375-901 LOT 2  
EWA 5 - 617 SPECIMEN 1532  
OCT 30 - 61

25-20341-2 AFTER SONIC TEST

STRUCTURE LAB. SONIC LAB.

MODEL - DS  
LEADING EDGE SEGMENT REINFORCED  
TEST COMPLETED  
DWG 25-20375-902 LOT 1  
EWA 5-6171 SPECIMEN 1523  
SEPT - 28 - 51

DS-1 LEADING EDGE, RING TEST COMPLETED (EWA 2489134  
5-6171 #1523 BACK VIEW 25-20375-902 LOT 1 9-28-61

25-20376-1 AFTER SONIC TEST

U3-4071-1000 (was BAC 1546-L-R3)

9-3-63

Volume I

Fig. 3-50

BOEING

NO. D2-30006

PAGE

3-50

STRUCTURE LAB SONIC LAB  
MODEL DS LEADING EDGE  
SEGMENT - RIVETED  
TEST - COMPLETED  
DWG 25 - 20375-903 LOT 1  
EWA 5 - 617 SPECIMEN 1529  
NOV 10 - 61

25-20376-2 AFTER SONIC TEST

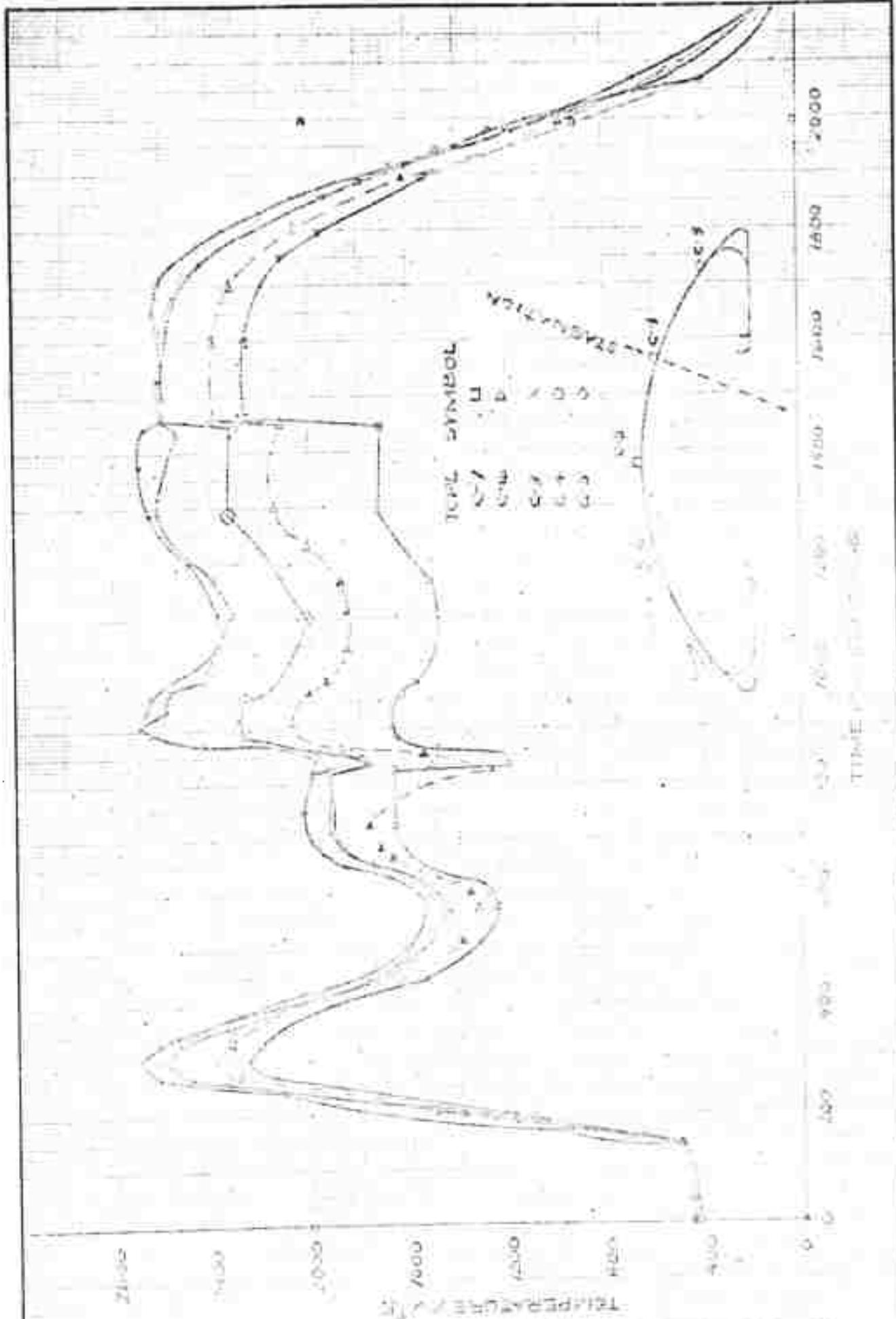
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03-4071-1000

9-3-63

72

BOEING NO. D2-80085 →  
Volume I PAGE. 3-70

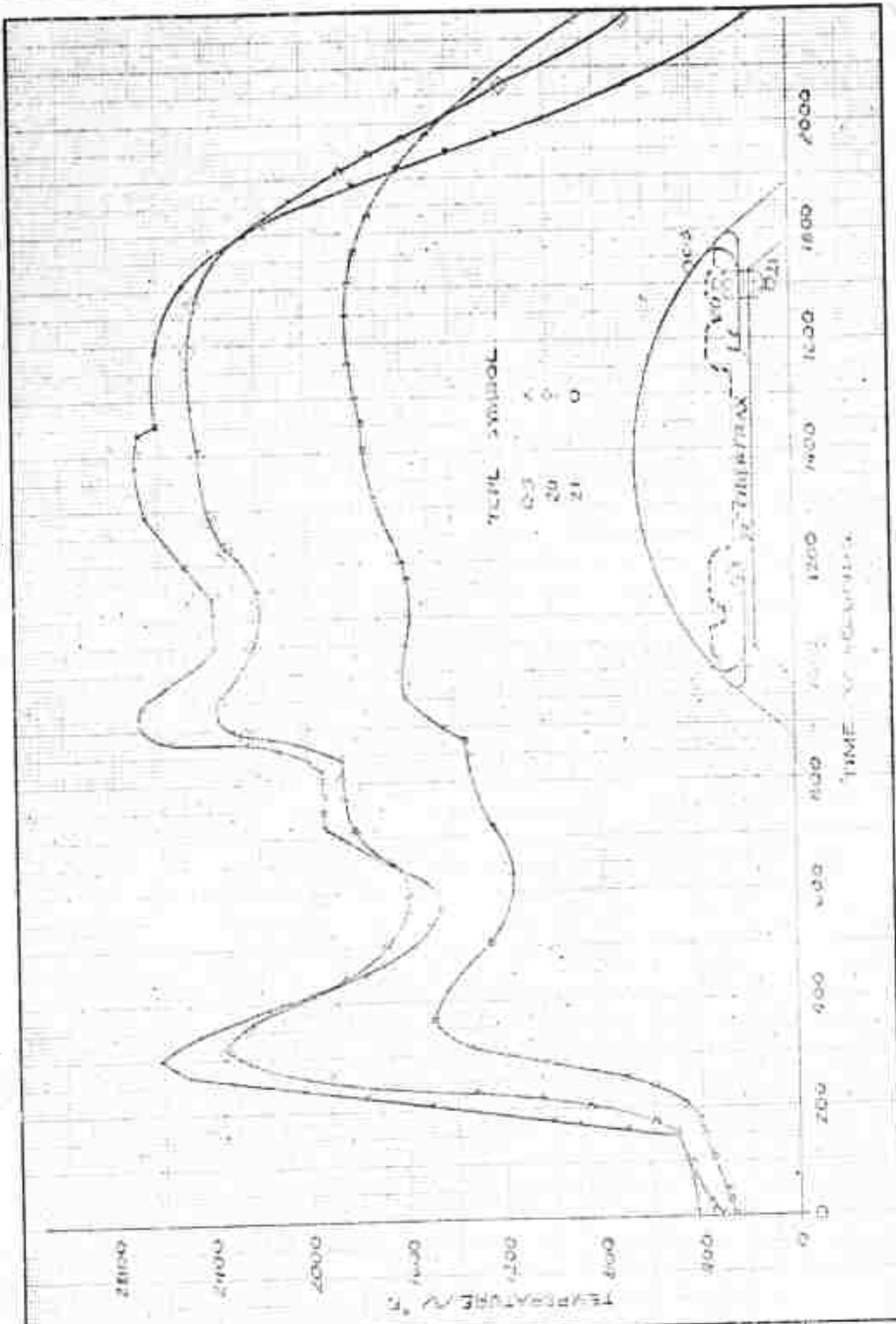


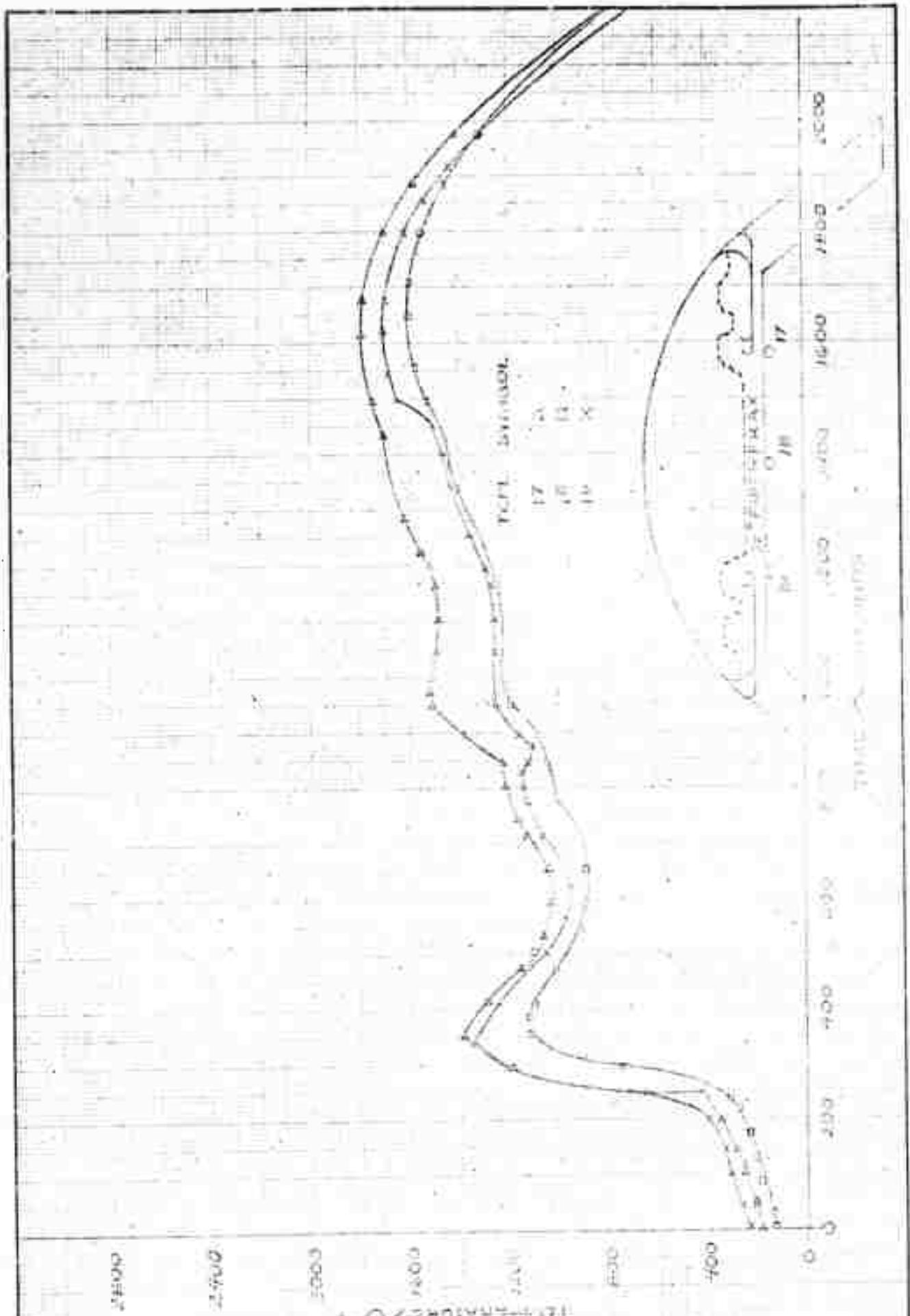
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| APR   |         |      |
| APR   |         |      |
|       |         |      |

AERONAUTICAL  
TECHNICAL DRAWING  
727 FORWARD LEADING EDGE

BOEING AIRPLANE COMPANY  
SEATTLE WA, WASHINGTON

PAGE 271  
104249

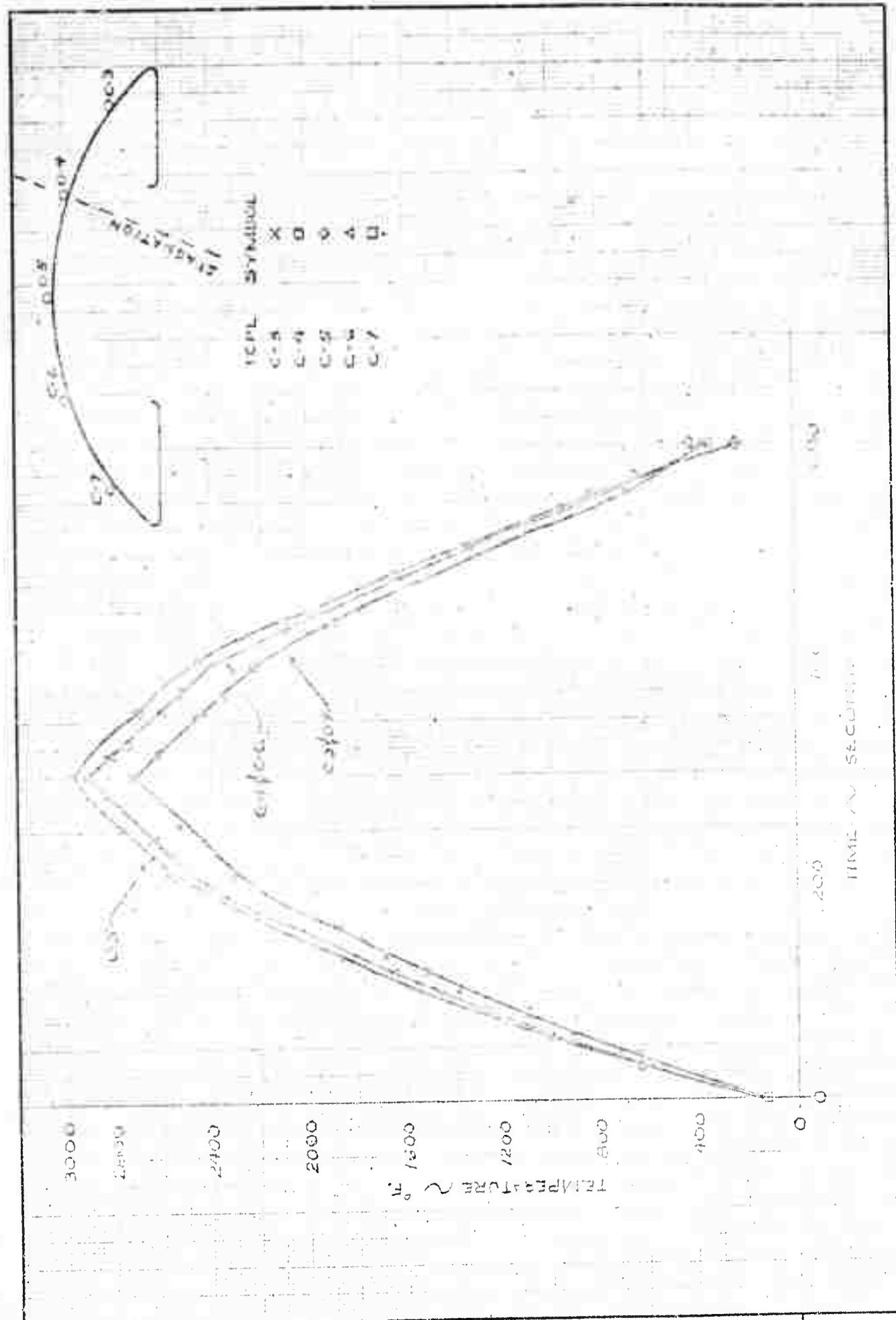




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| AMR                     |         |                        | TESTS                              |           |
| AMR                     |         |                        |                                    |           |
|                         |         |                        | AERONAUTICAL STABILITY AND CONTROL |           |
| BOEING AIRPLANE COMPANY |         | Seattle 24, Washington |                                    | PAGE 2-72 |
| SAC-A11-C-R8            |         | Volume I               |                                    | 50027     |

75-

9-3-63



|       |               |         |         |      |
|-------|---------------|---------|---------|------|
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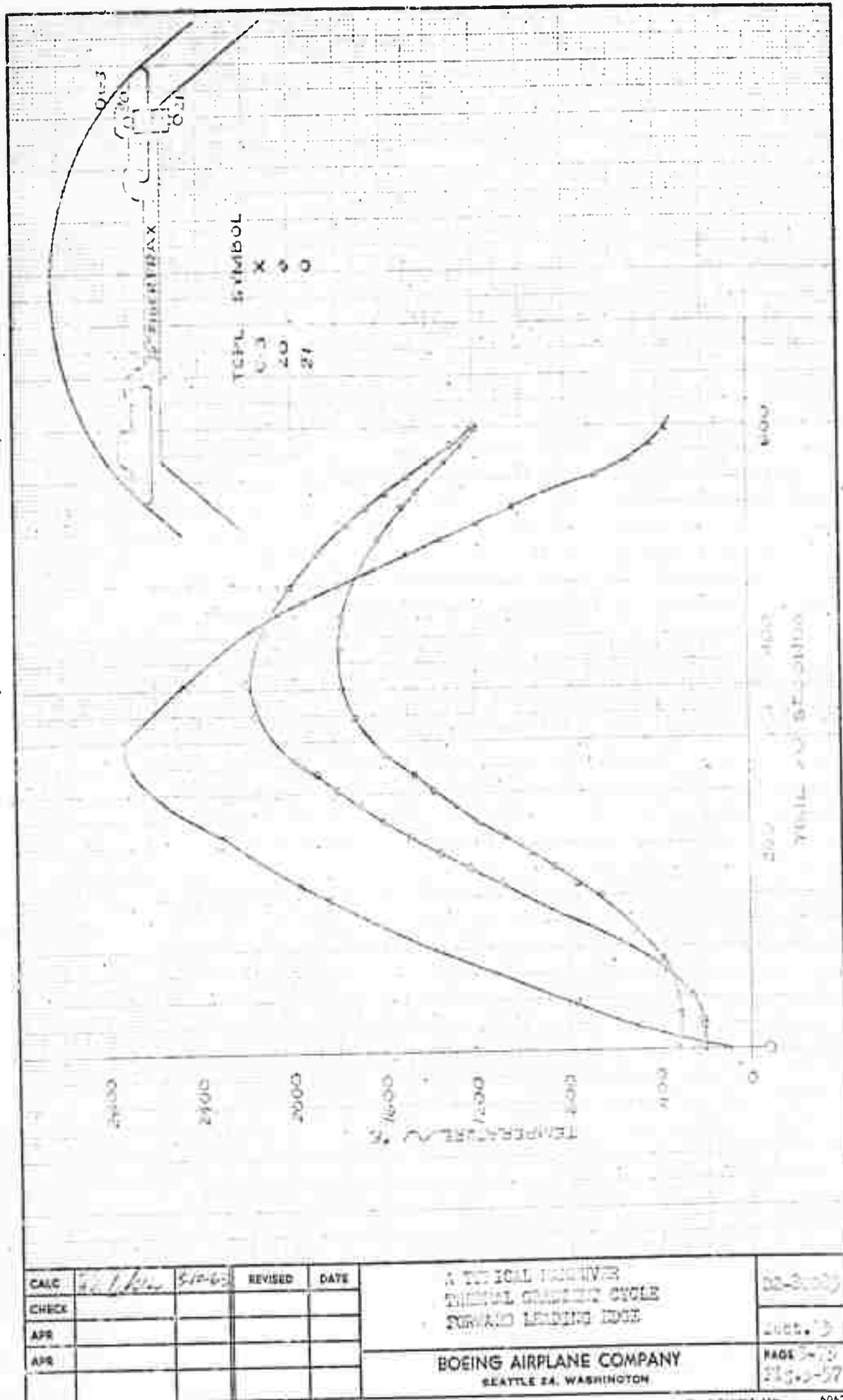
A TYPICAL MANEUVER  
THERMAL GRADIENT CYCLE  
FORWARD LEADING EDGE

**BOEING AIRPLANE COMPANY**  
SEATTLE 24, WASHINGTON

12-20025

Sect. 3

PAGE 3-74  
Fig. 2-56



72

BAC 161 C-R4

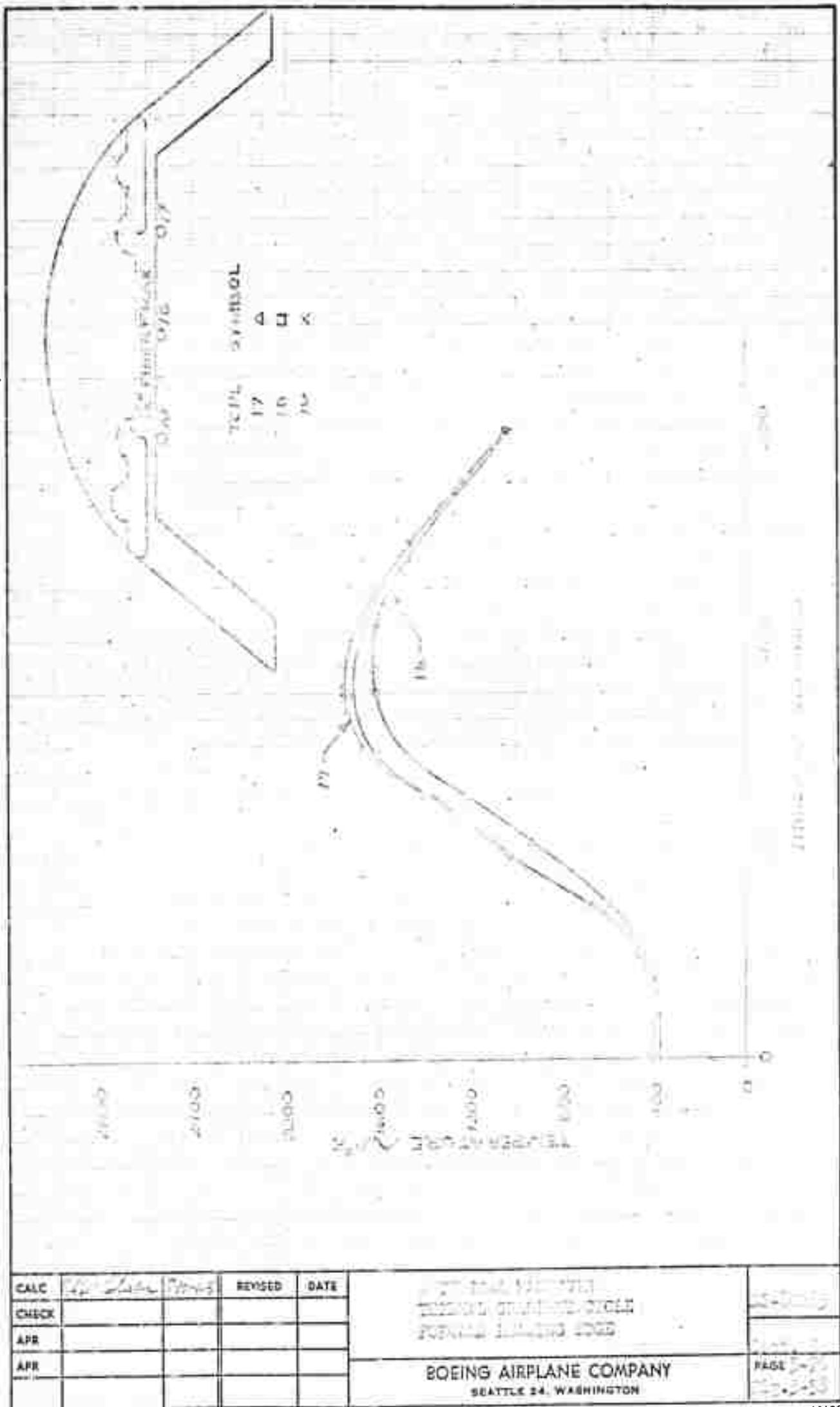
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ANALYTICAL INVESTIGATION  
OF THE CRYSTALLIZATION CYCLE  
OF POLY(1,3-PHENYLENE TEREPHTHALIC ACID)

BOEING AIRPLANE COMPANY  
SEATTLE 24, WASHINGTON

Volume I <sup>KoE</sup> ALBANESE TOOL  
TRADING PAPER

60629



78

BAC 461 C-R4 9-3-63

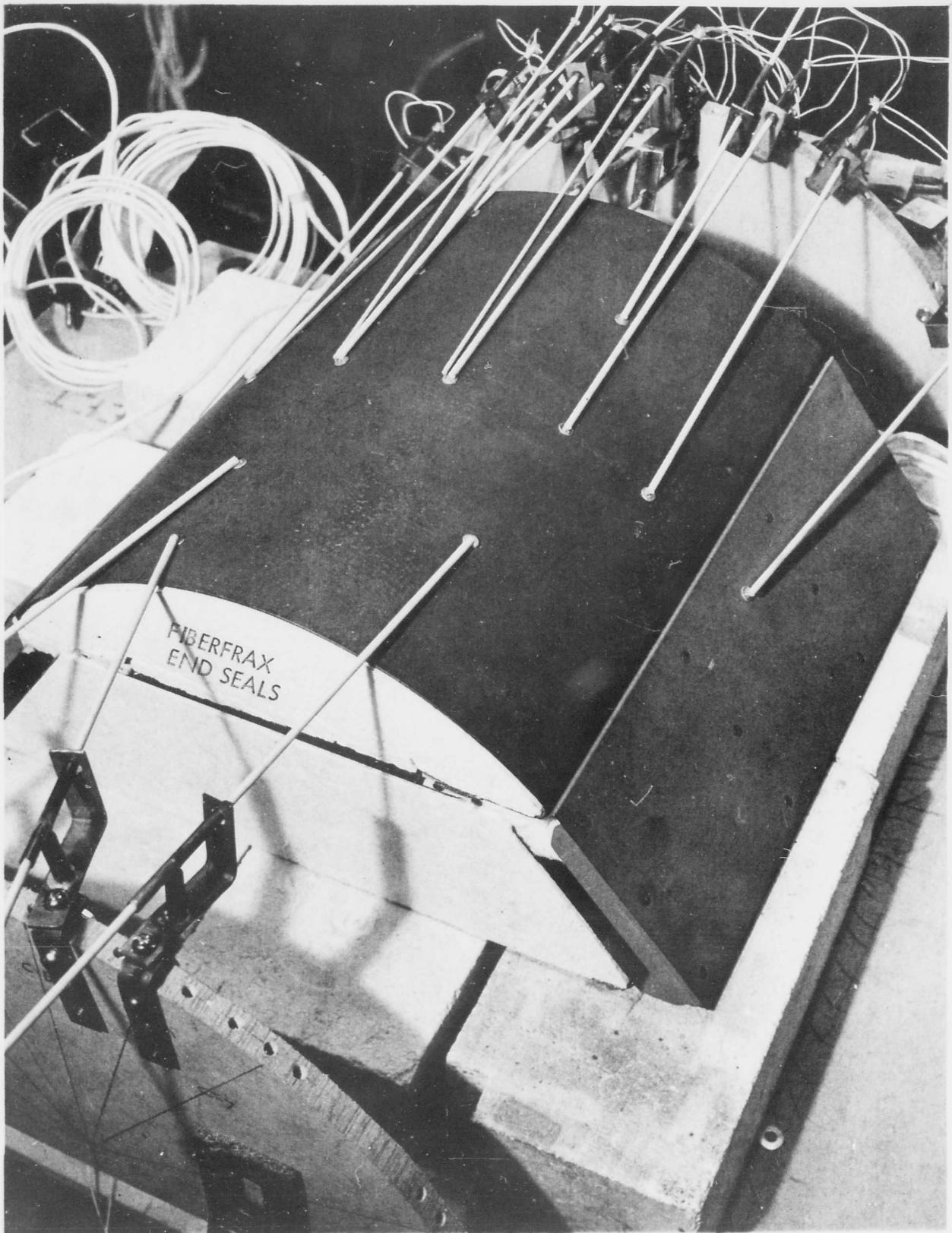
THE BOEING AIRPLANE COMPANY  
SEATTLE 24, WASHINGTON

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60629



25-20372-I BEFORE HEAT TEST

U3-4071-1000 (was BAC 1546-L-R3)

9-3-63

BOEING

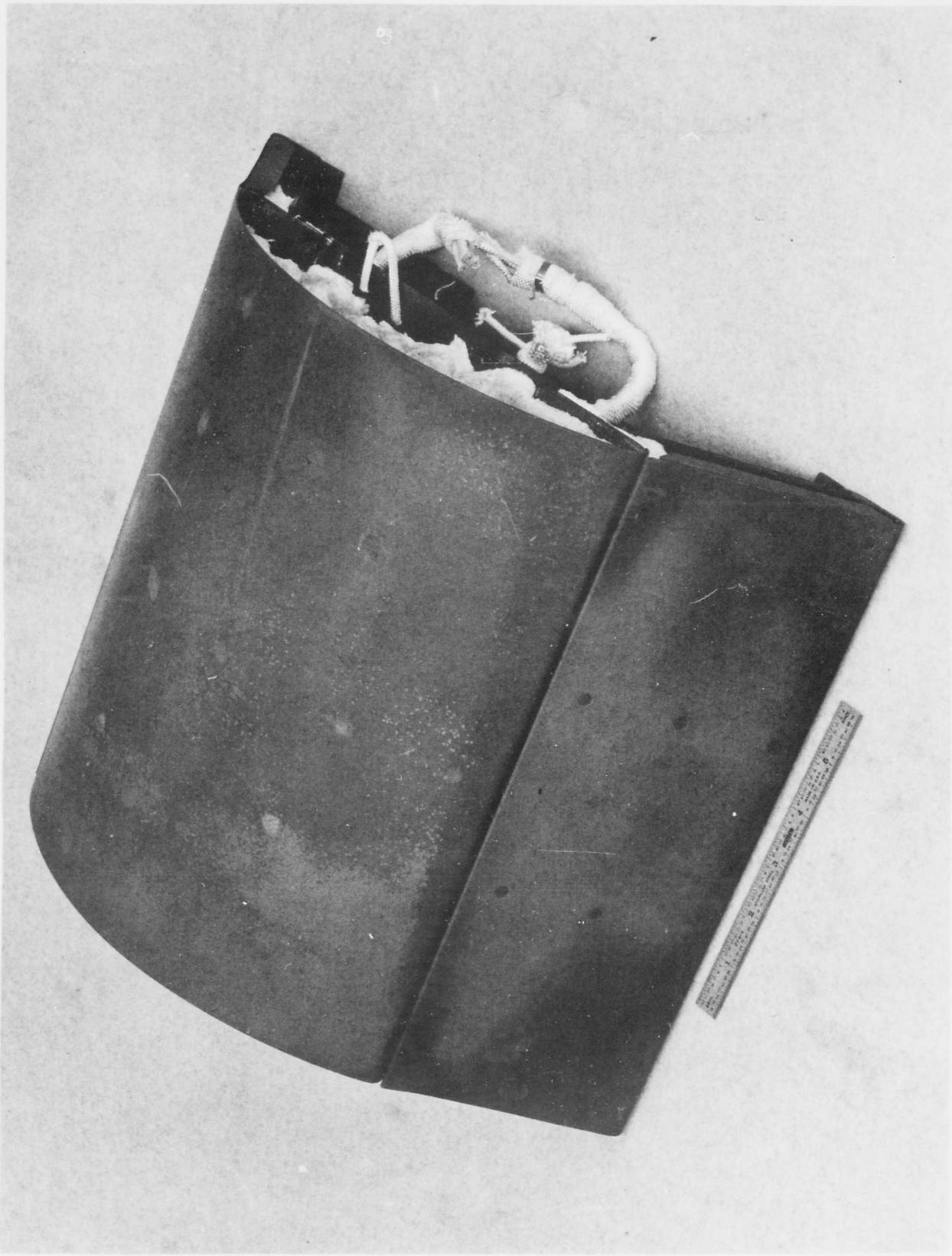
NO. D2-60085

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3-77





25-20372-I AFTER HEAT TEST

U3-4071-1000 (was BAC 1546-L-R3)

9-3-63

BOEING

NO. D2-80085

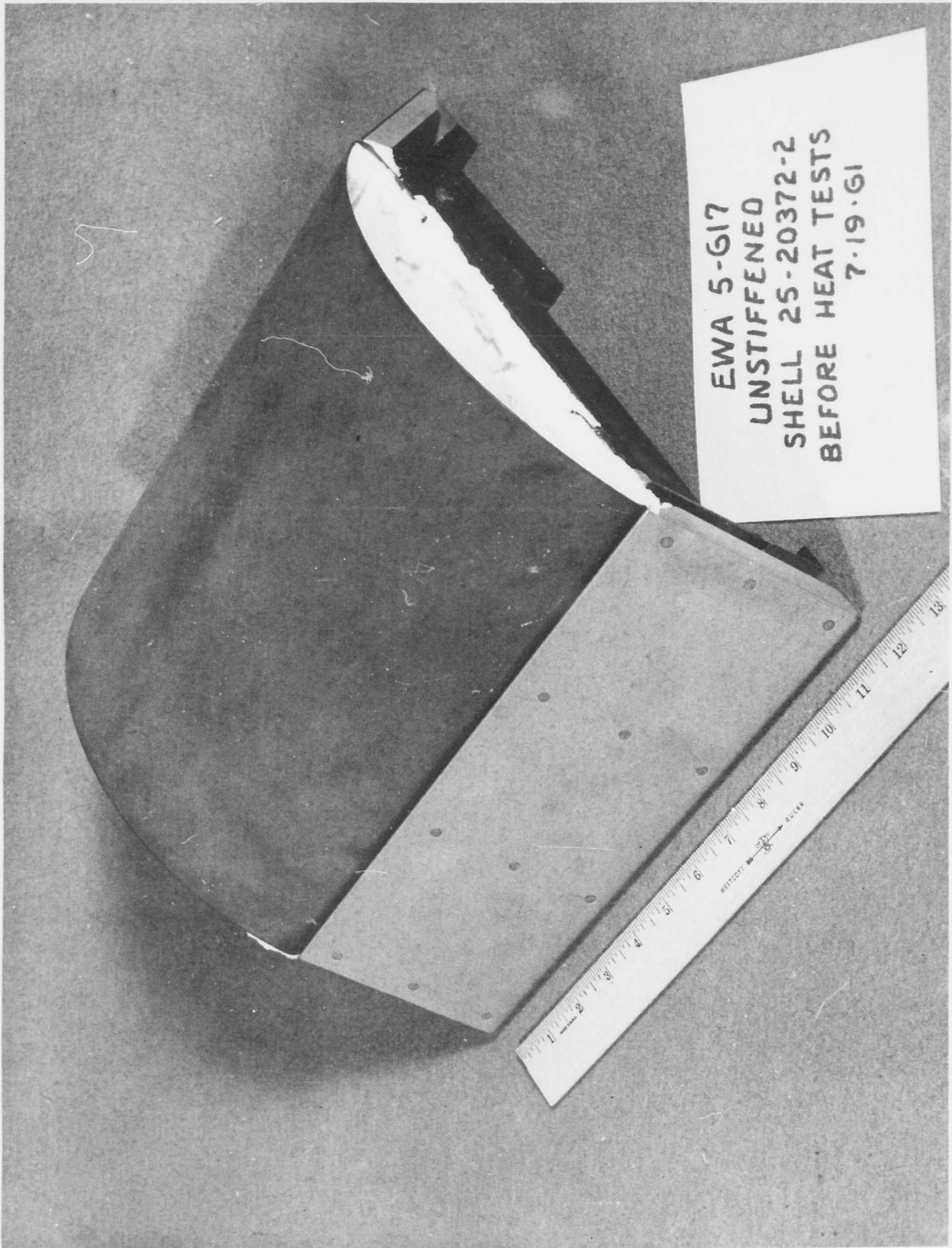
Volume I

Fig. 3-60

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25-20372-2 BEFORE HEAT TEST

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9-3-63

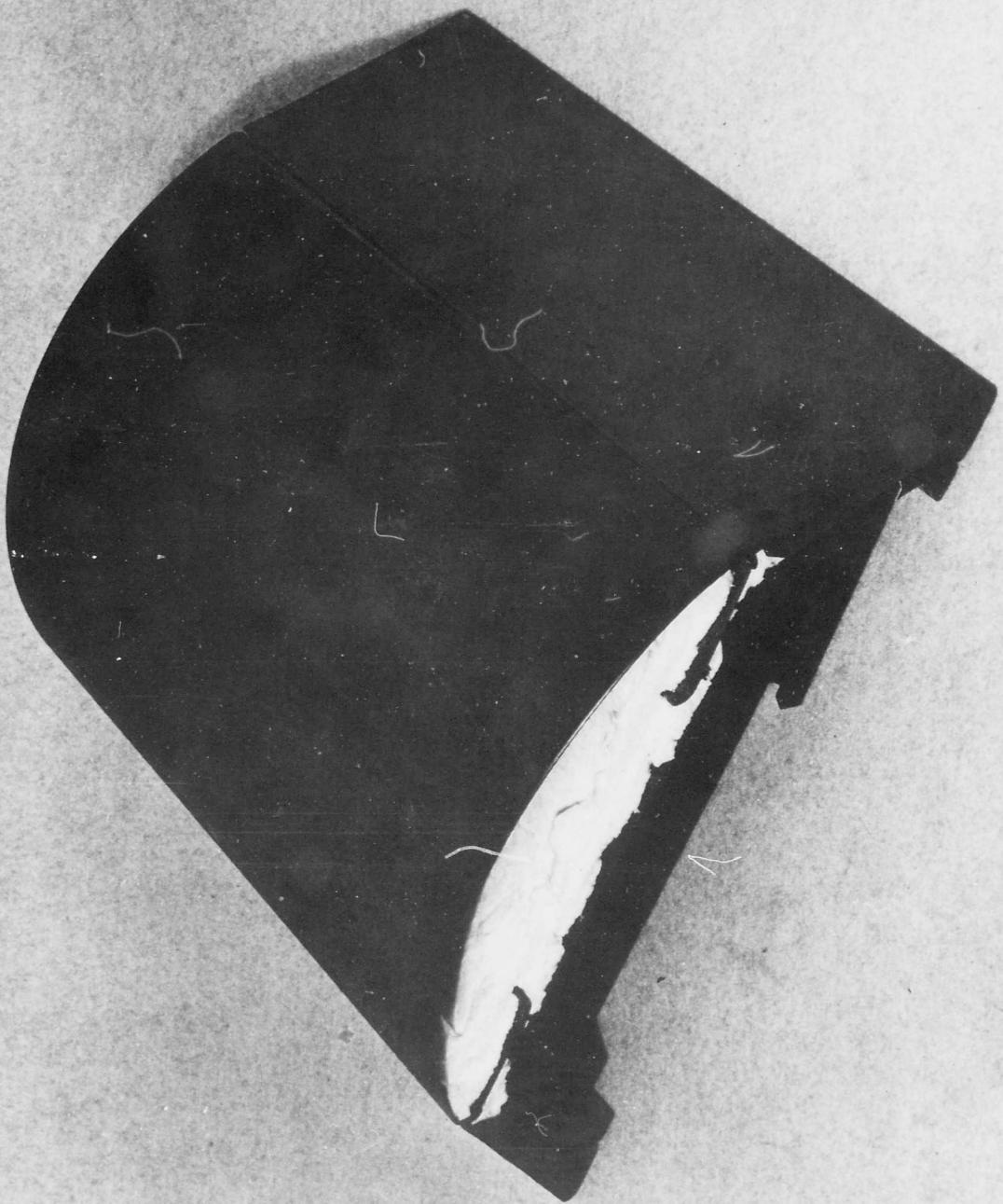
BOEING

NO. D2-80085

Fig. 3-61

PAGE

3-79



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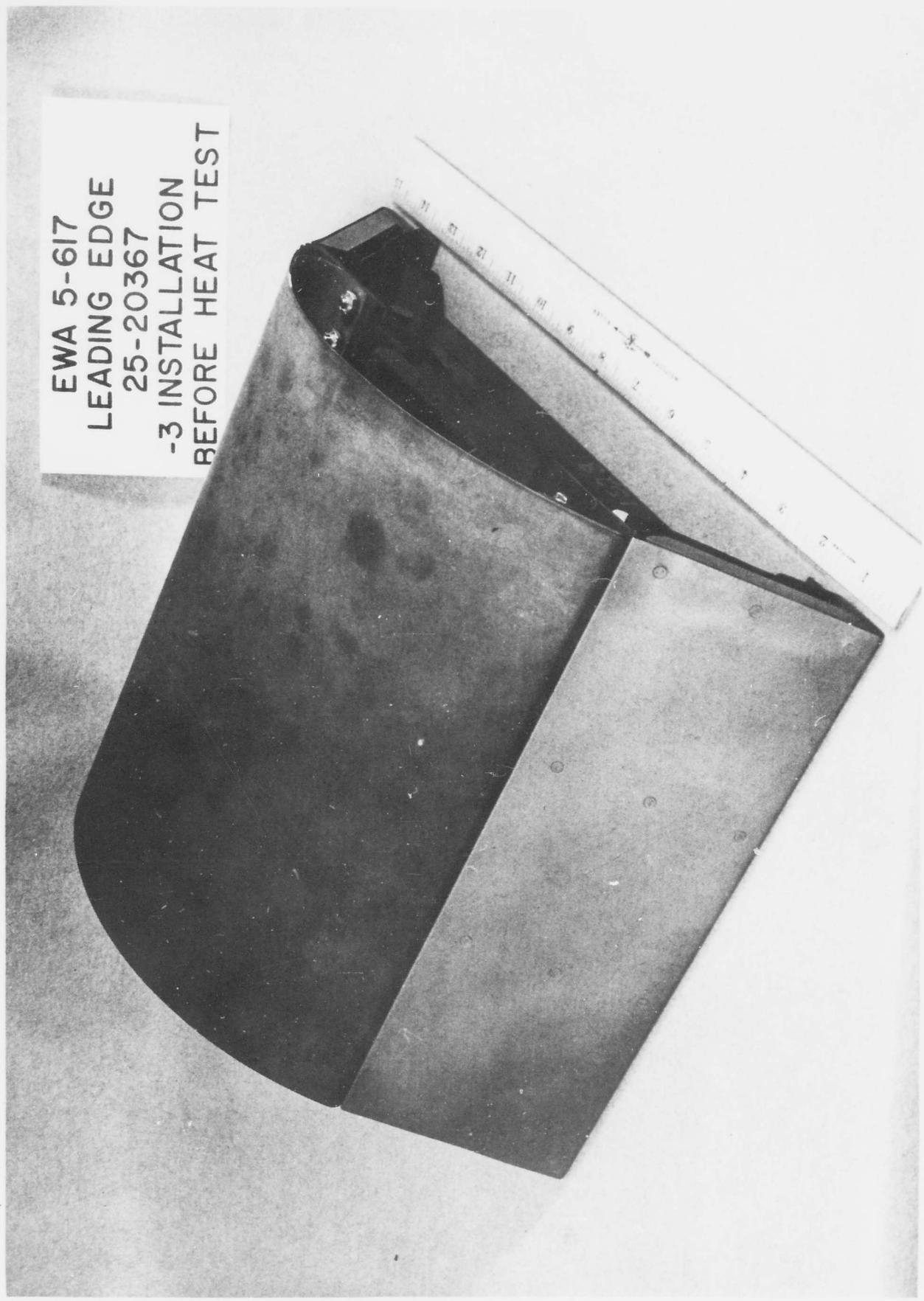
U3-4071-1000 (was BAC 1546-L-R3)

9-3-63

BOEING NO. D2-80065  
Volume I Fig. 3-62 PAGE 3-30



EW A 5-617  
LEADING EDGE  
25-20367  
-3 INSTALLATION  
BEFORE HEAT TEST



25-20367-I BEFORE HEAT TEST

BAC 1546 L-R3

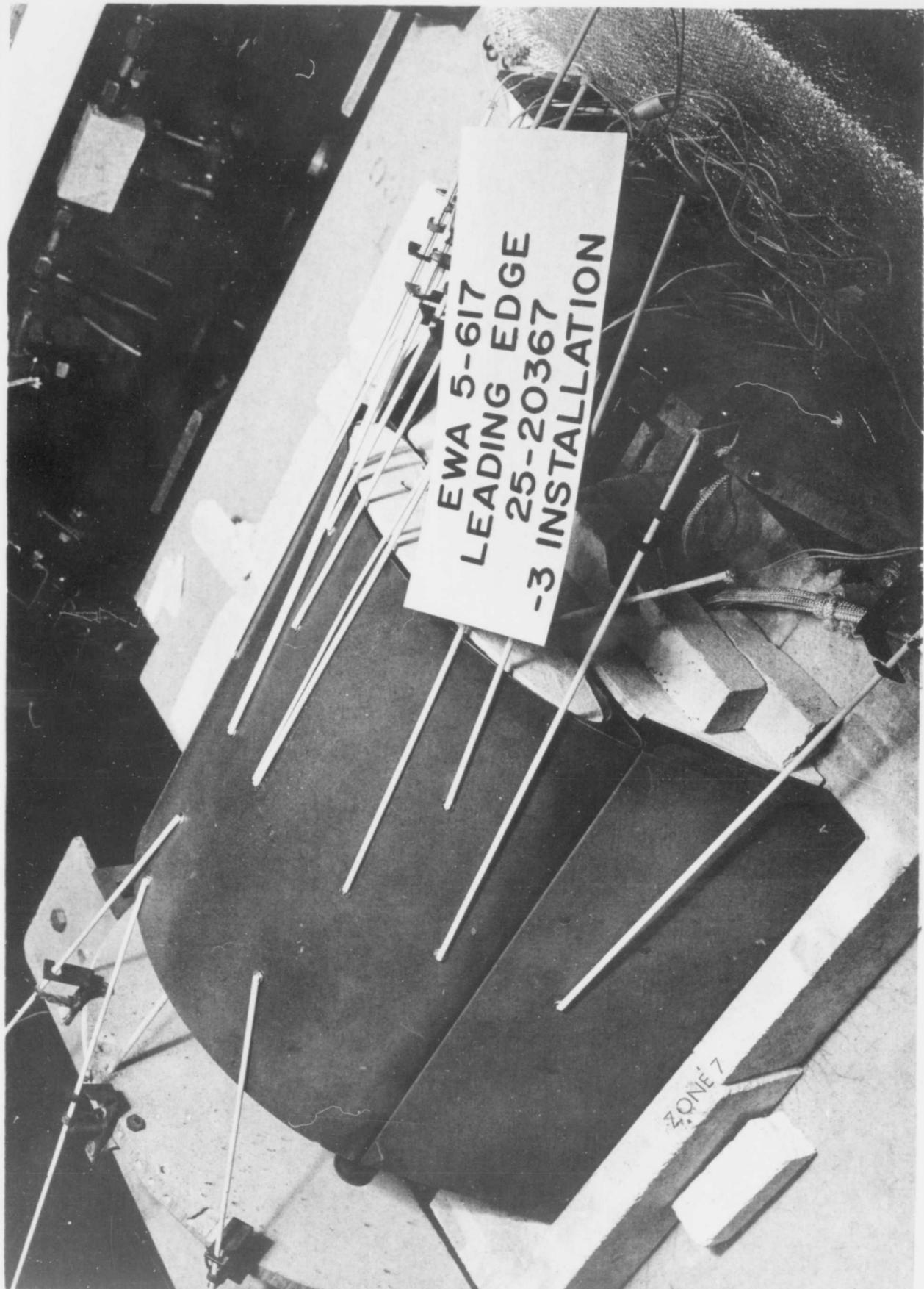
9-3-63

Volume 7 Eia. 3-63

BOEING NO. D2-80085

PAGE 3-31

9



25-20367-I AFTER HEAT TEST

BAC 1546 L-R3

9-3-63

BOEING

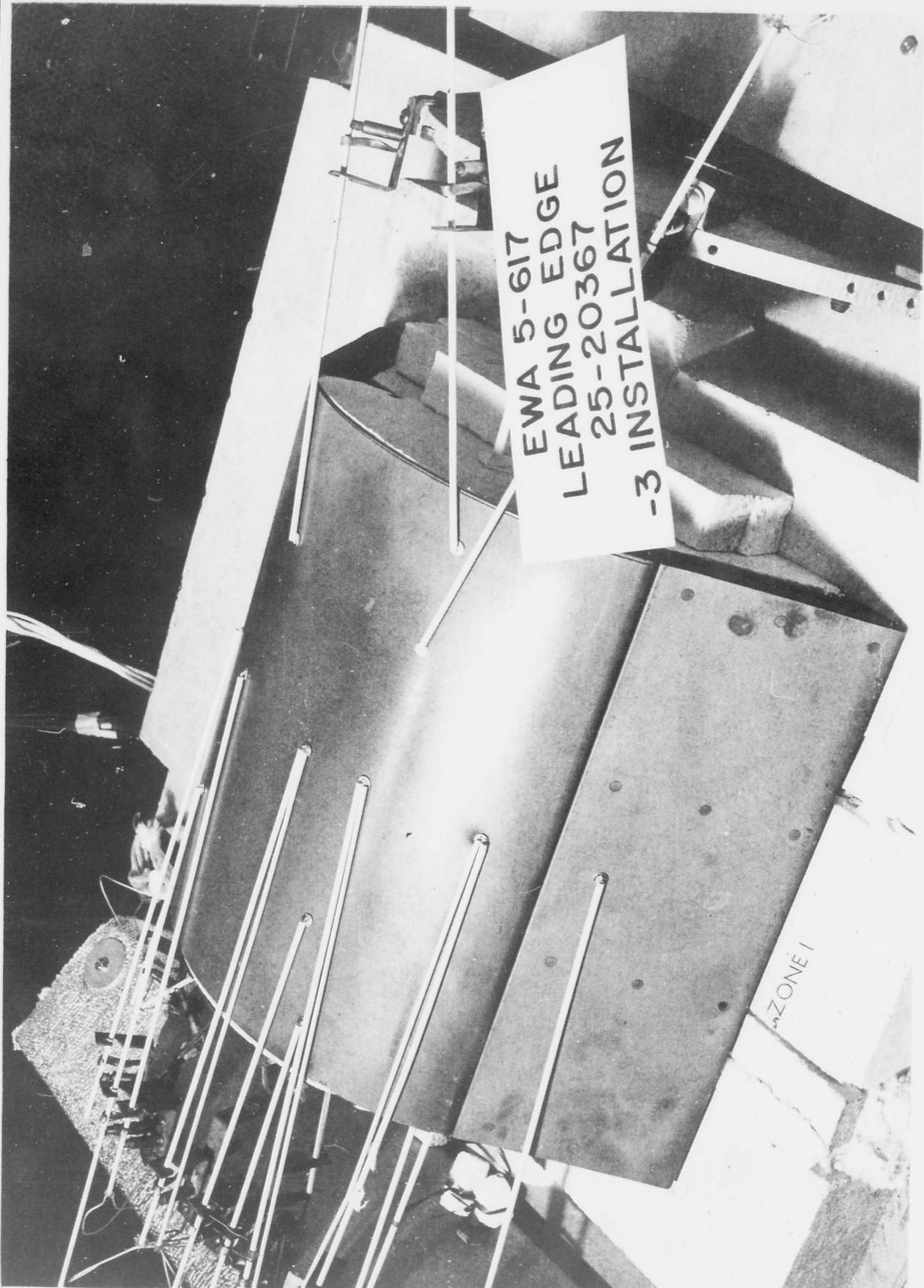
NO. D2-60085

Fig. 3-64

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3-32





25-20367-I AFTER HEAT TEST

BAC 1546 L-R3

9-3-63

Volume I Fig. 3-65

BOEING

NO. D2-80005

PAGE

3-83

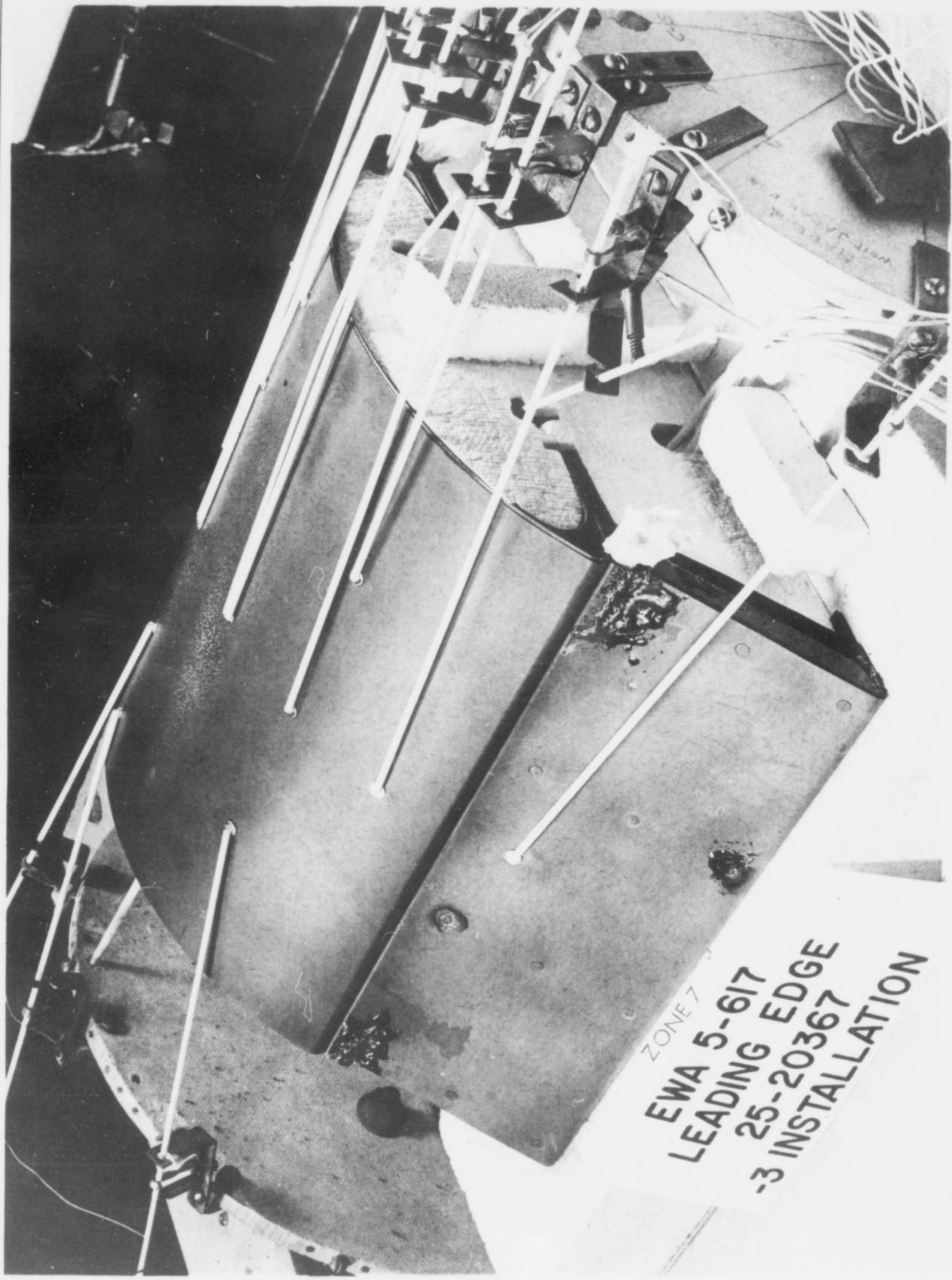


25-20367-2 BEFORE HEAT TEST

BAC 1546 L-R3

9-3-63

BOEING | NO. D2-J0055  
Volume I Fig. 3-66 | PAGE 3-34



25-20367-2 AFTER HEAT TEST

BAC 1846 L-R3

9-3-63

Volume I Fig. 3-67.

**BOEING**

NO. D2-80085

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25-20367-2 AFTER HEAT TESTS

BAC 1546 L-R3

9-3-63

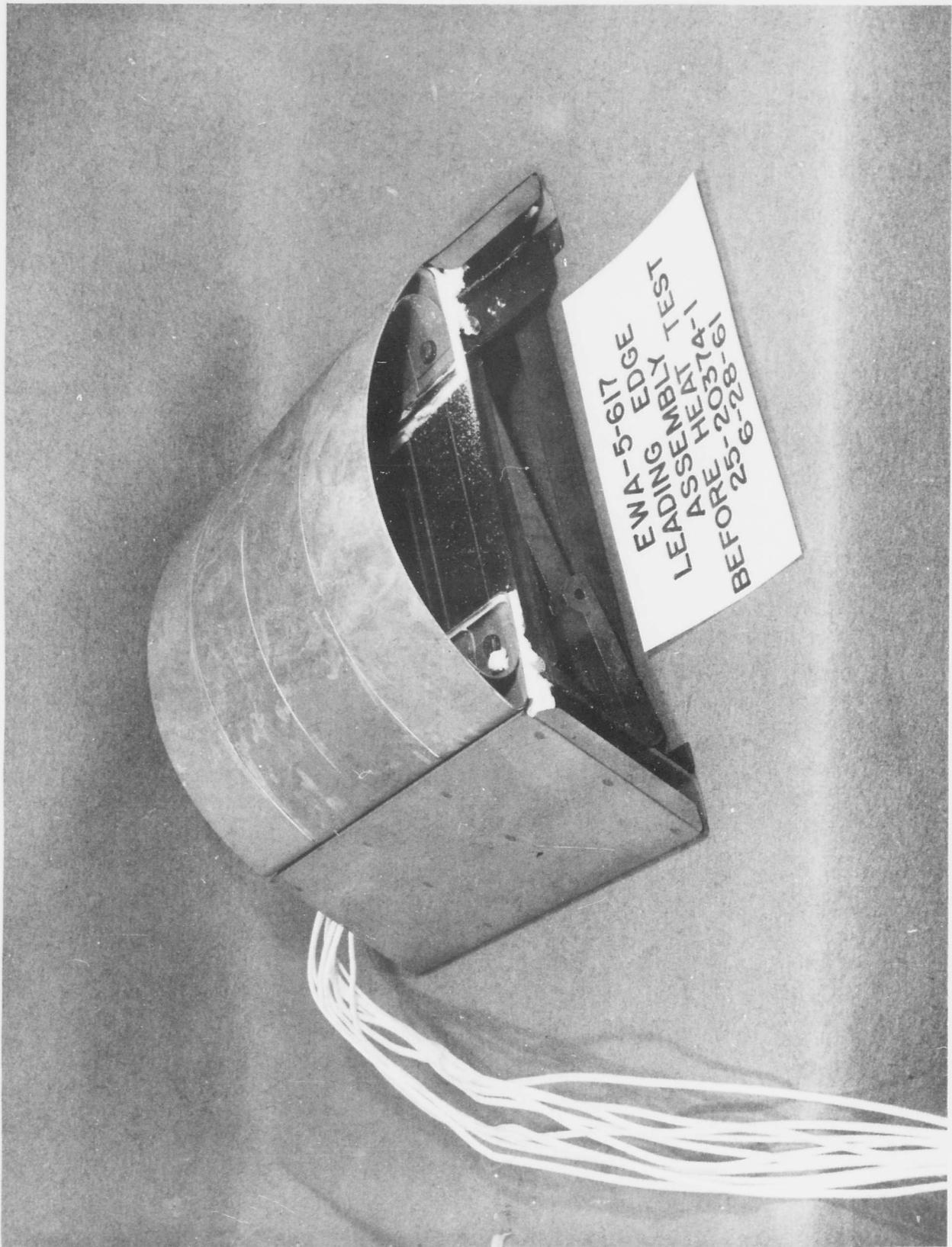
BOEING

NO. D2-30085

Volume I Fig. 3-68

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25-20378-I BEFORE HEAT TEST

U3-4071-1000 (was BAC 1546-L-R3)

9-3-63

Volume I

BOEING

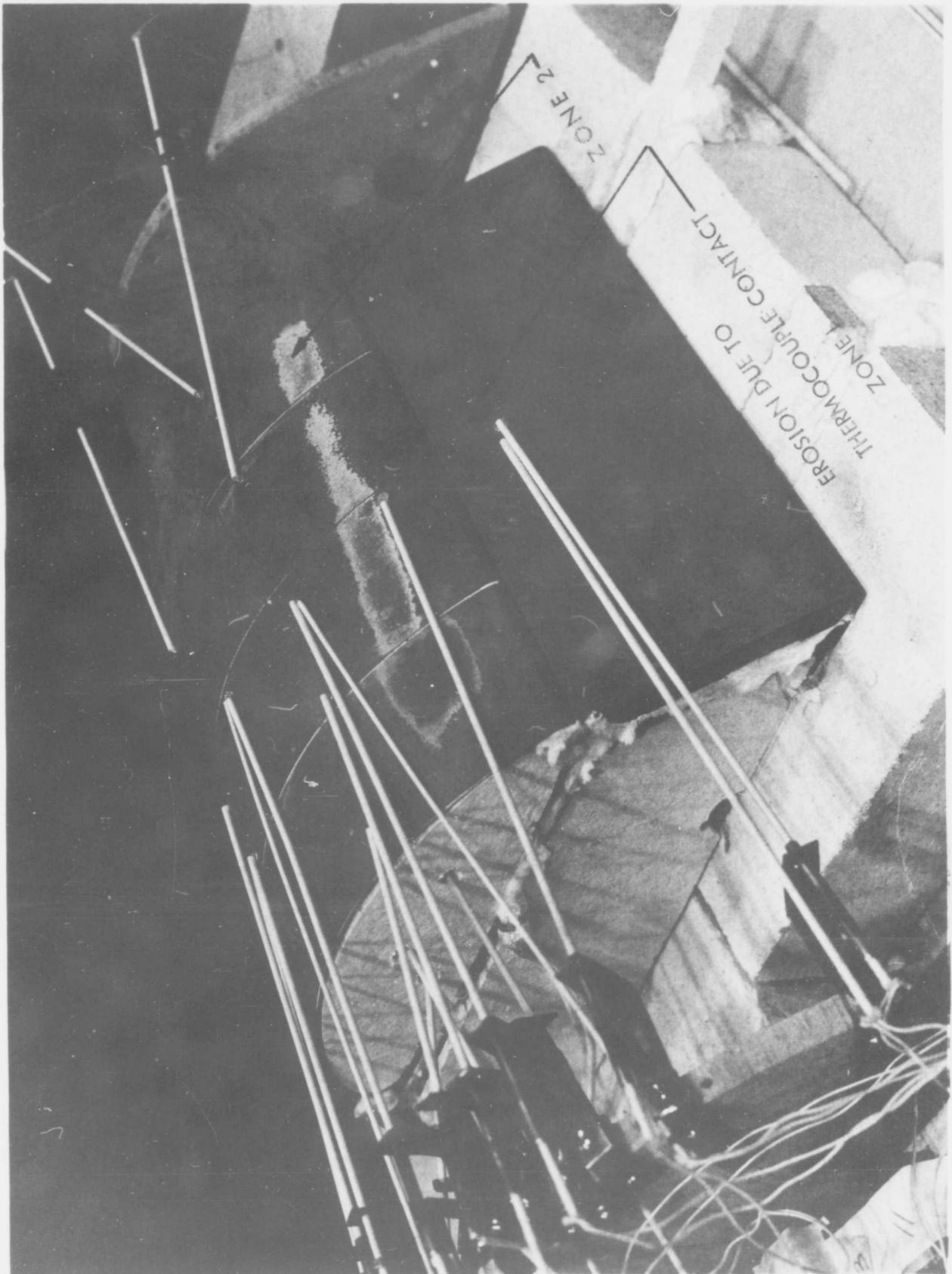
Fig. 3-62

PAGE 3-87

NO.

D2-80085



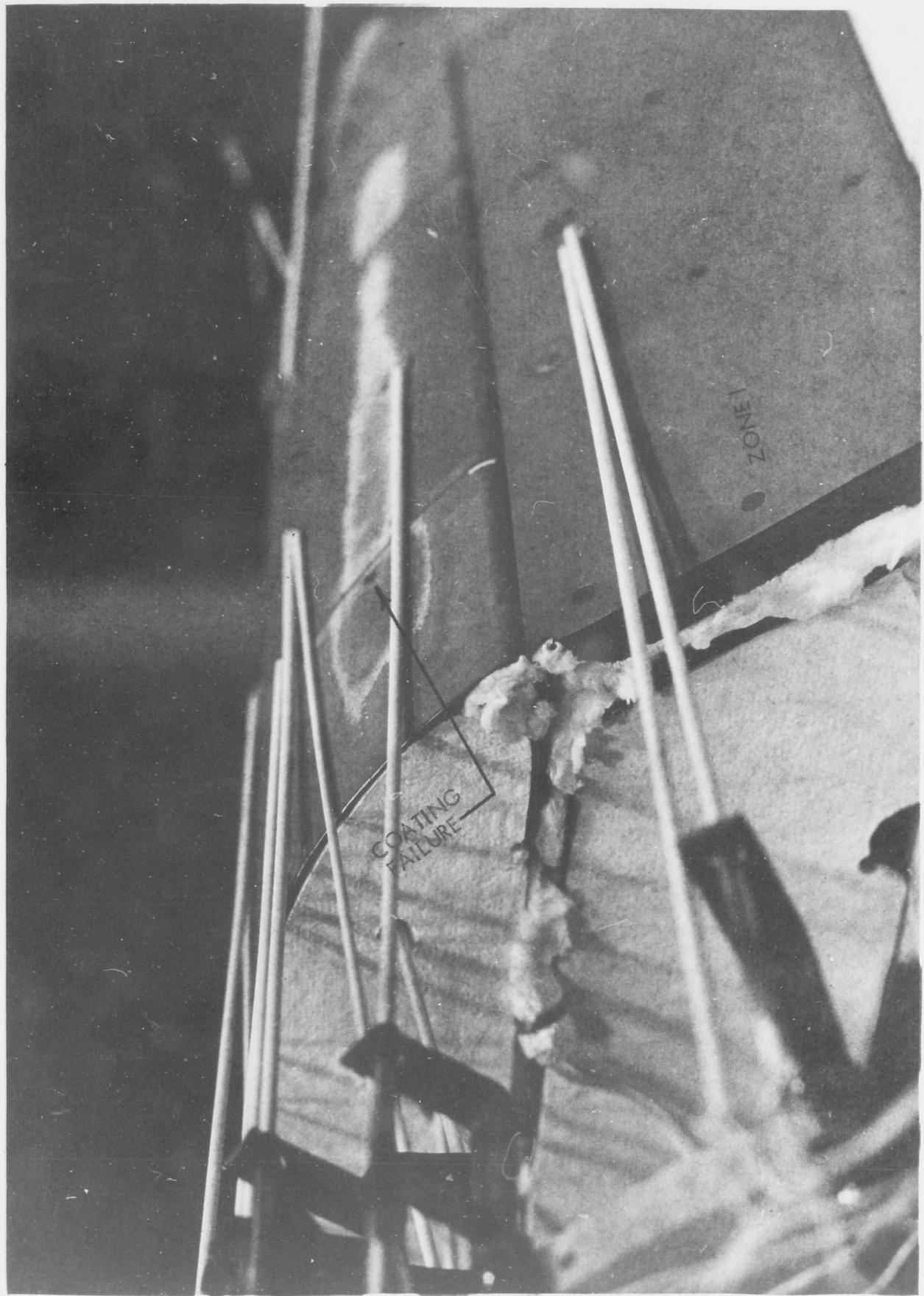


25-20378-I AFTER FOUR HEAT CYCLES

BAC 1546 L-R3

9-3-63

BOEING | NO. D2-80065  
Volume I Fig. 3-70 | PAGE 3-38



25-20378-I AFTER FOUR HEAT CYCLES

U3-4071-1000 (was BAC 1546-L-R3)

9-3-63

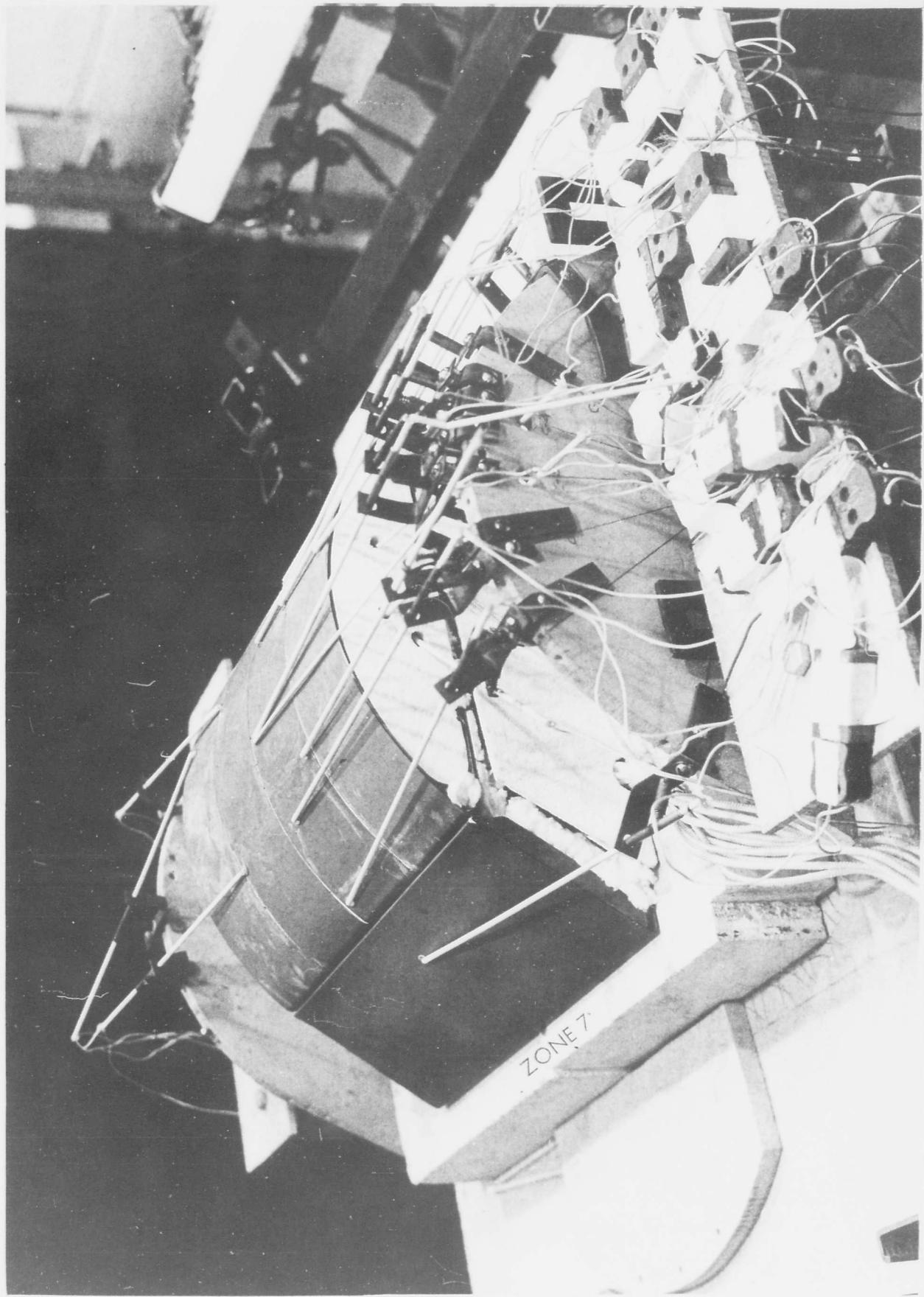
BOEING

NO. D2-10065

Volume I Fig. 3-71

PAGE 3-89





25-20378-I AFTER FOUR HEAT CYCLES

U3-4071-1000 (was BAC 1546-L-R3)

9-3-63

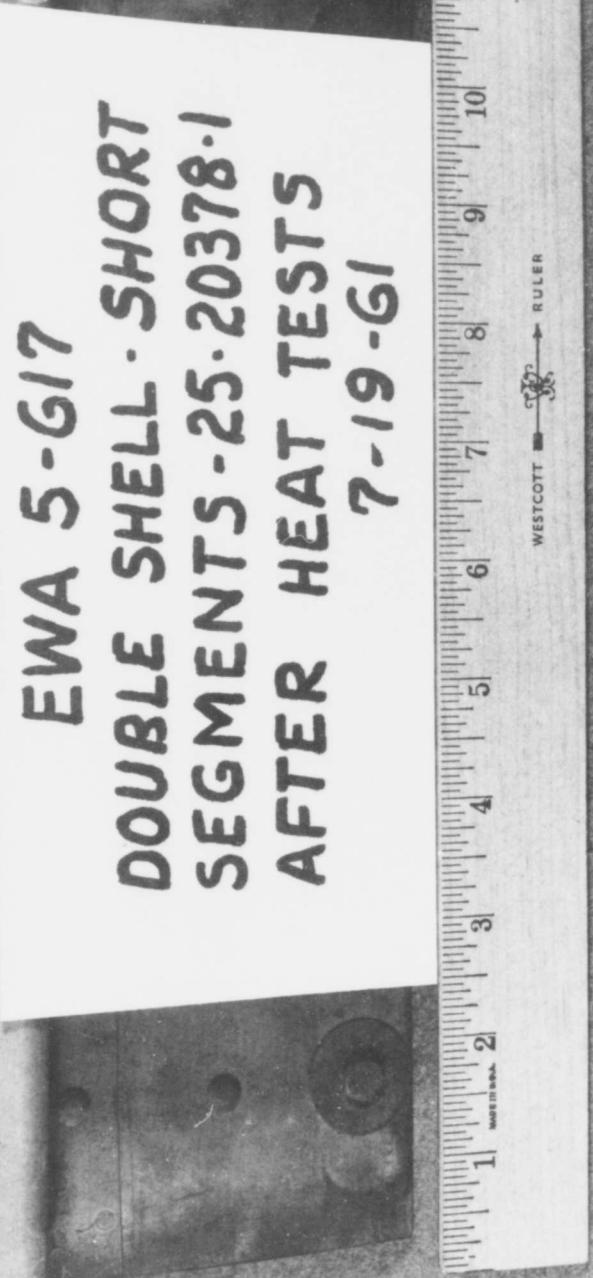
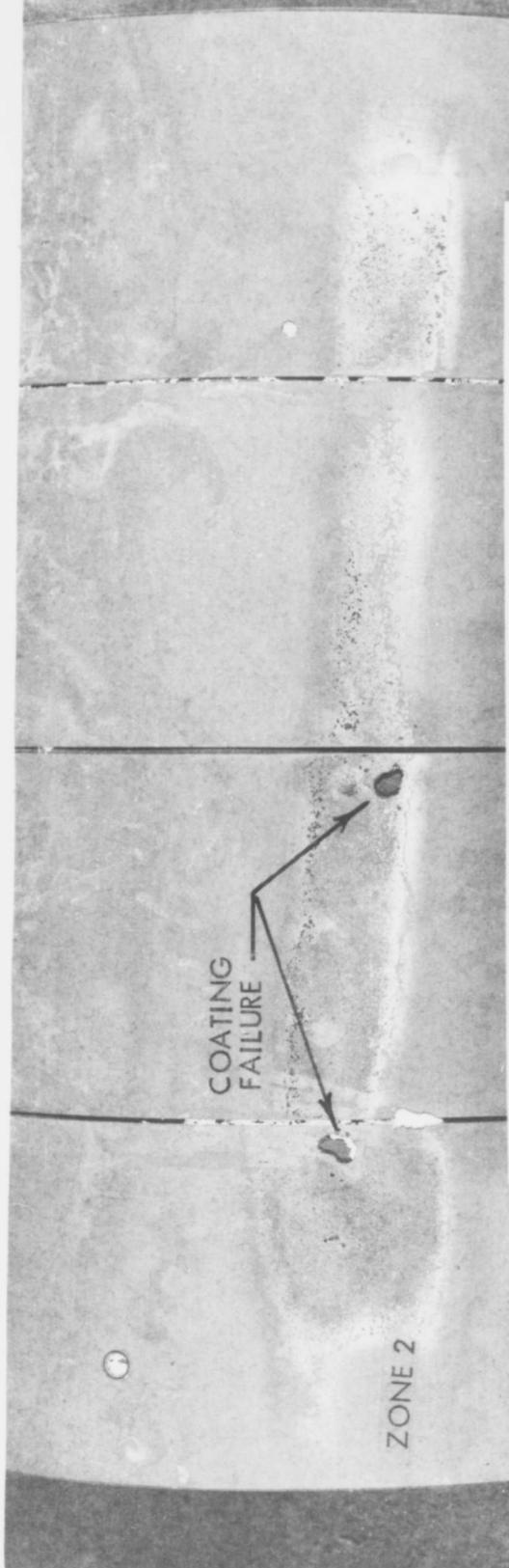
BOEING NO. D2-80088

Volume I Fig. 3-72 PAGE 3-90



DS-1 - EWA 5-617 DOUBLE SHELL - SHORT SEGMENTS  
25-20378-1 AFTER HEAT TESTING 7-19-61

2482609

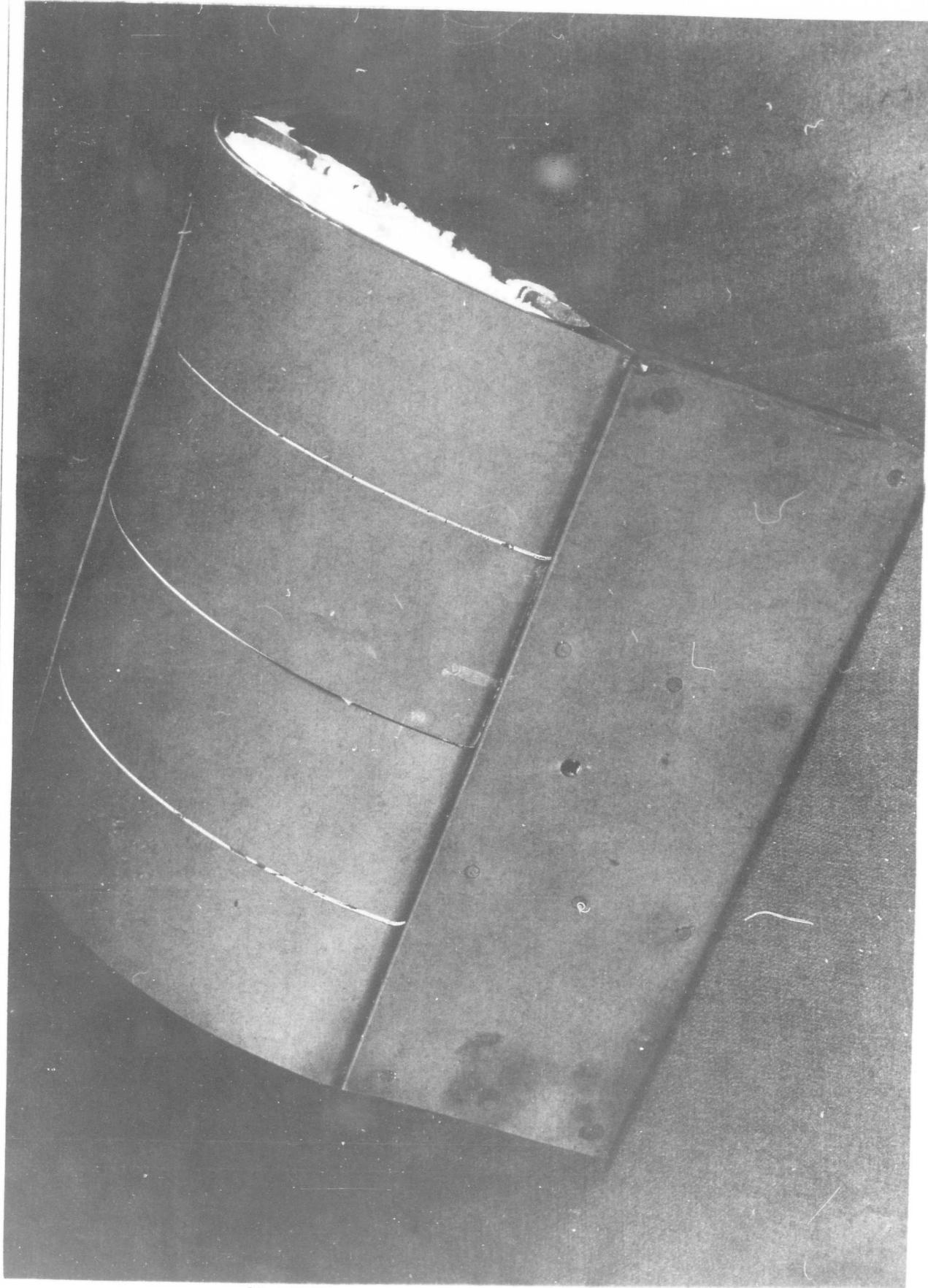


25-20378-1 AFTER HEAT TESTS

U3-4071-1000 (was BAC 1546-L-R3)

9-3-63

NO. D2-90085  
BOEING  
MATERIAL Fig. 3-73 PAGE 3-91



25-20378-2 AFTER HEAT TEST

U3-4071-1000 (was BAC 1546-L-R3)

9-3-63

BOEING

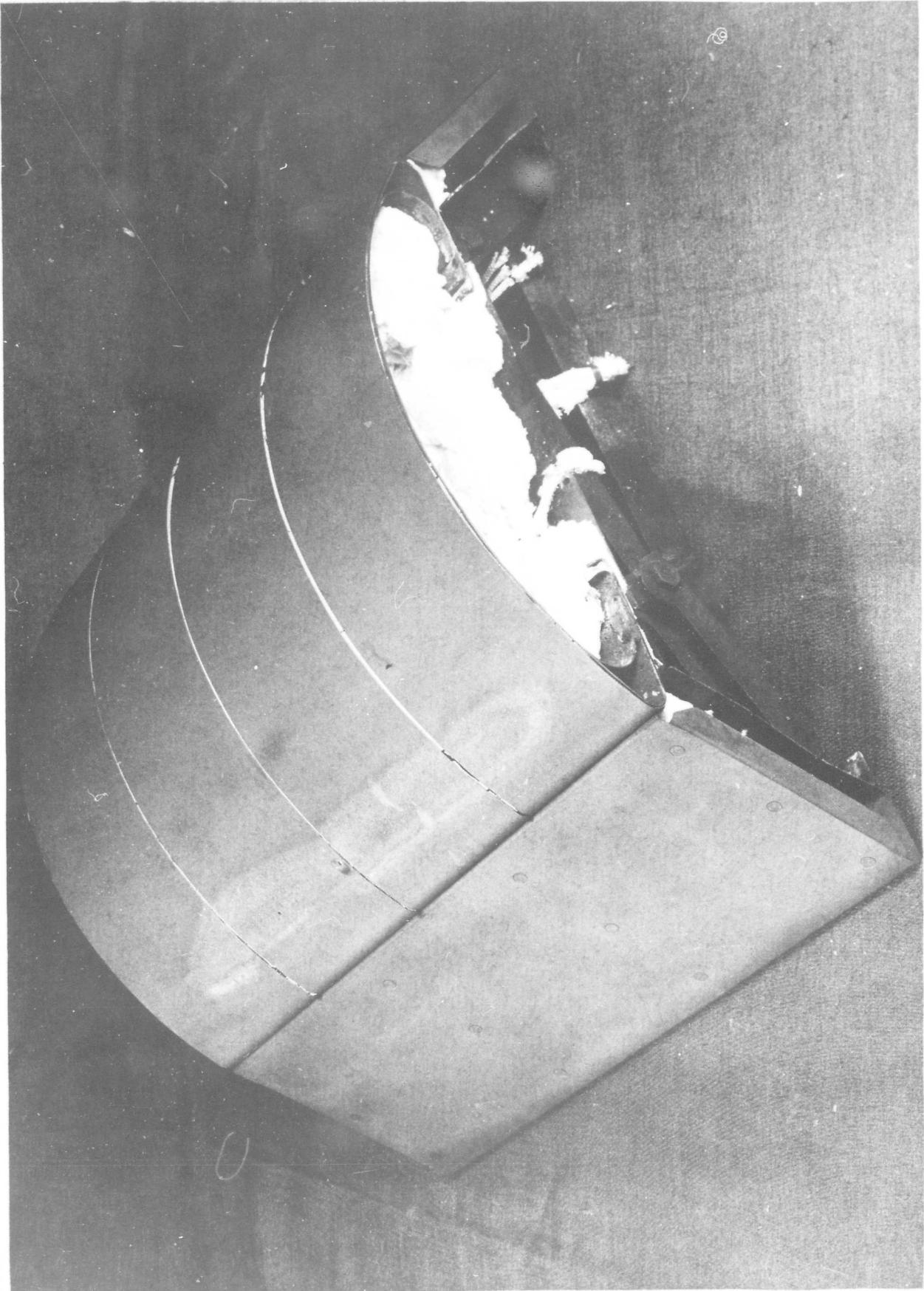
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PAGE

8-92

Fig. 3-74





25-20378-2 AFTER HEAT TEST

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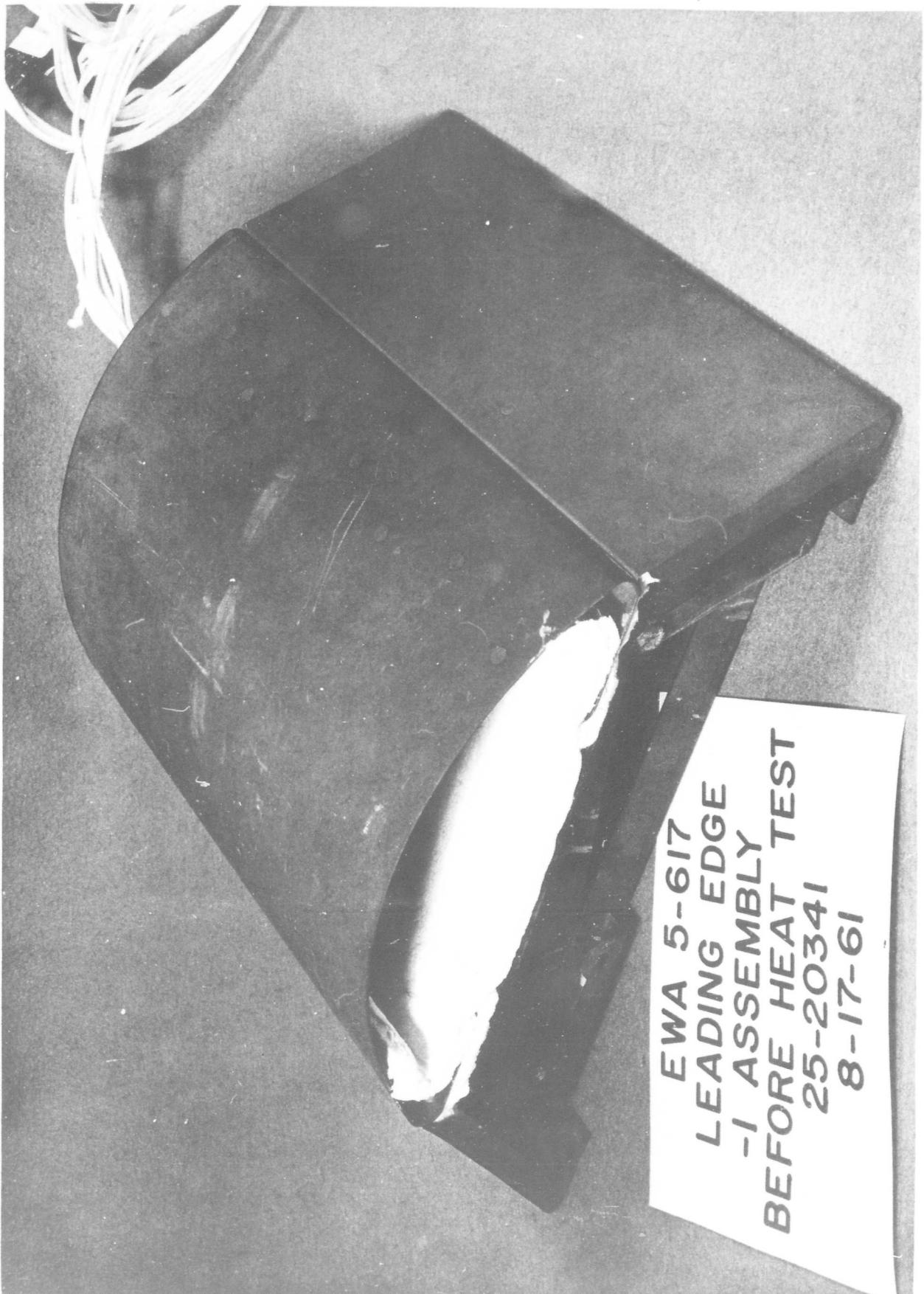
9-3-63

BOEING

NO. D2H-000

Fig. 3-75

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25-20341-I BEFORE HEAT TEST

EWA 5-617  
LEADING EDGE  
-I ASSEMBLY  
BEFORE HEAT TEST  
25-20341  
8-17-61

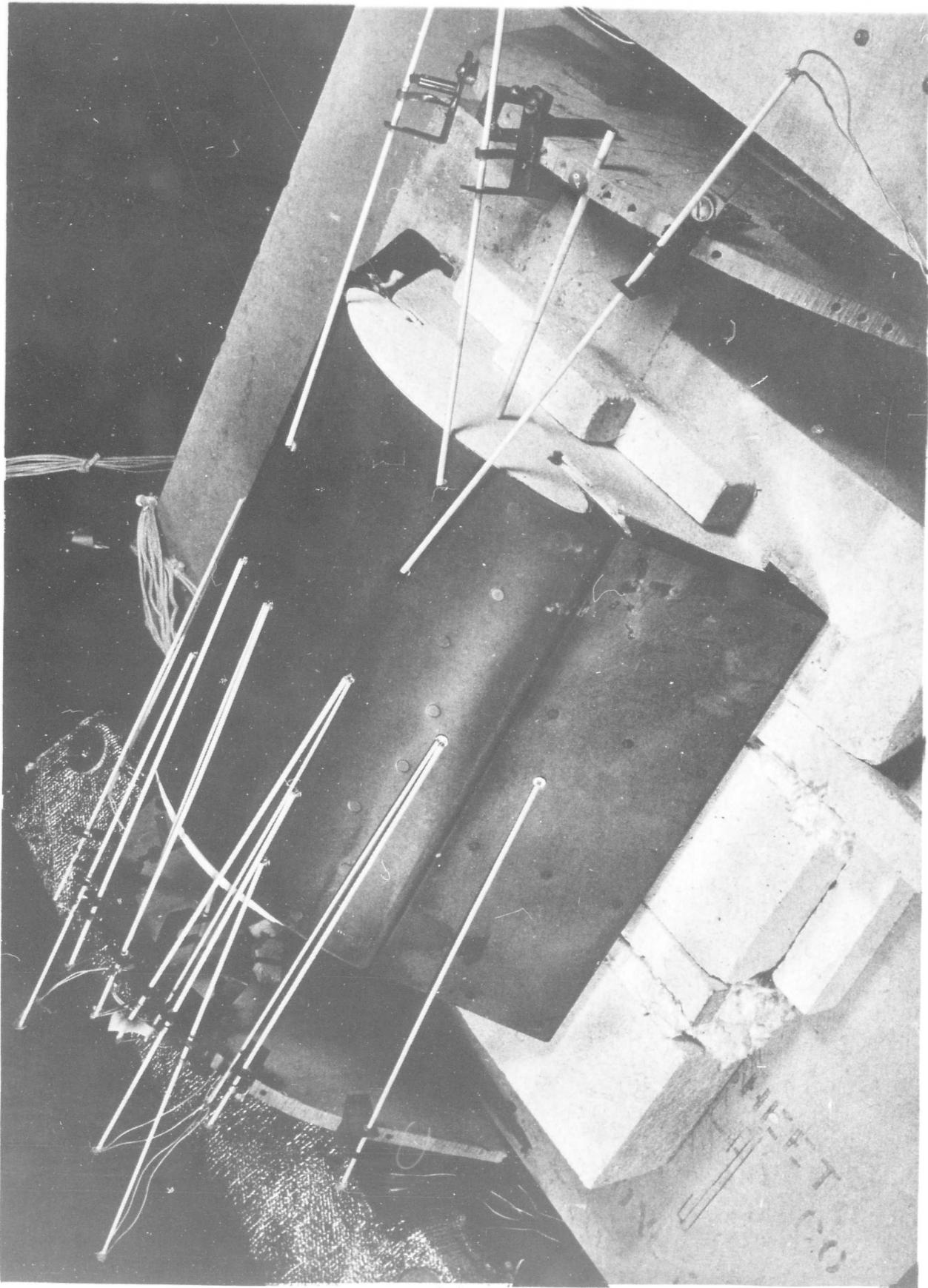
U3-4071-1000 (was BAC 1546-L-R3)

9-3-63

BOEING

NO. D2-1003  
PAGE 3-76





25-20341-L AFTER HEAT TEST

U3-4071-1000 (was BAC 1546-L-R3)

9-3-63

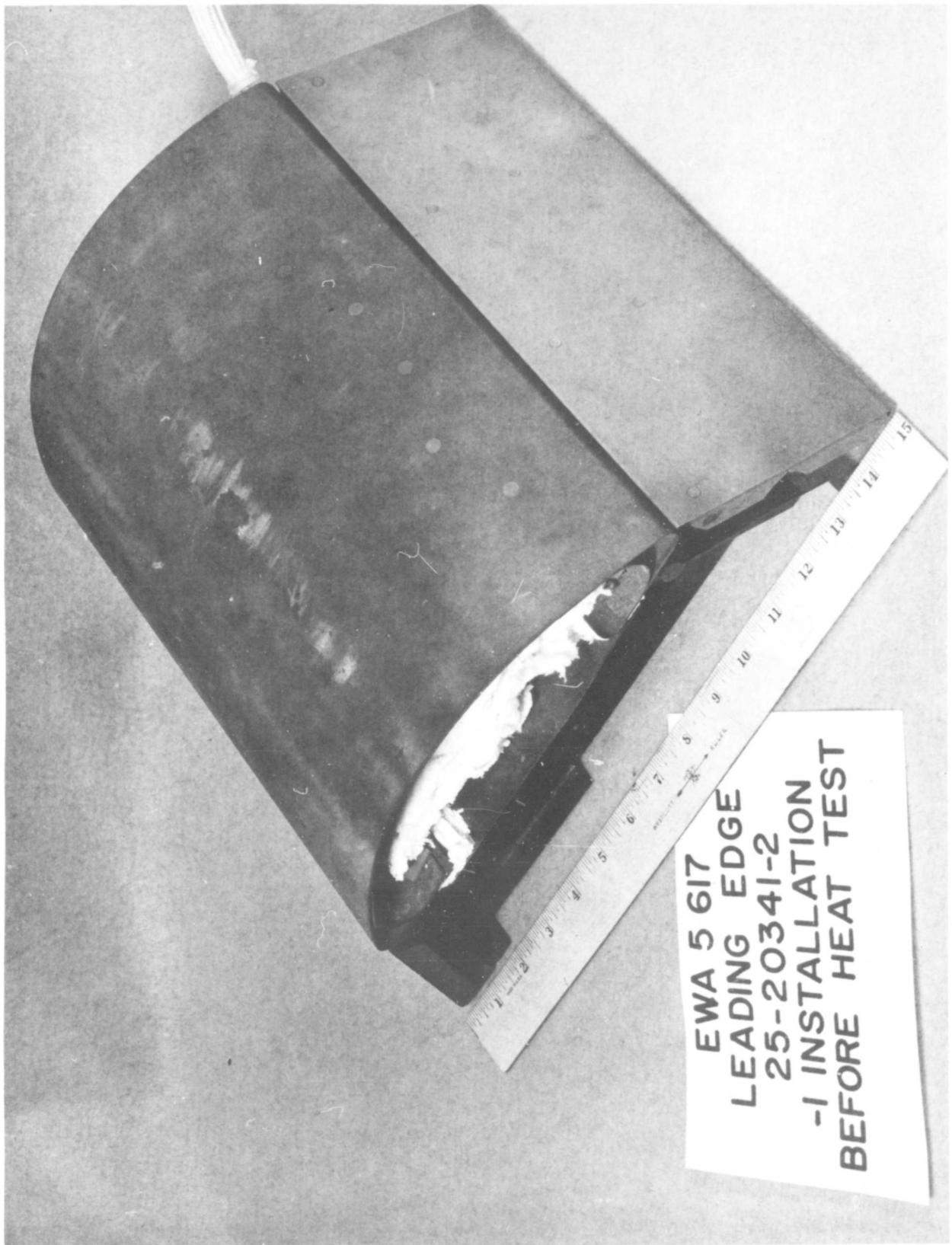
Fig. 3-77

BOEING

NO. D2-0085

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25-20341-2 BEFORE HEAT TEST

DS-1 LEADING EDGE EWA 5617 25-0541-2  
-1 INSTALLATION BEFORE HEAT TEST  
10-61

U3-4071-1000 (was BAC 1546-L-R3)

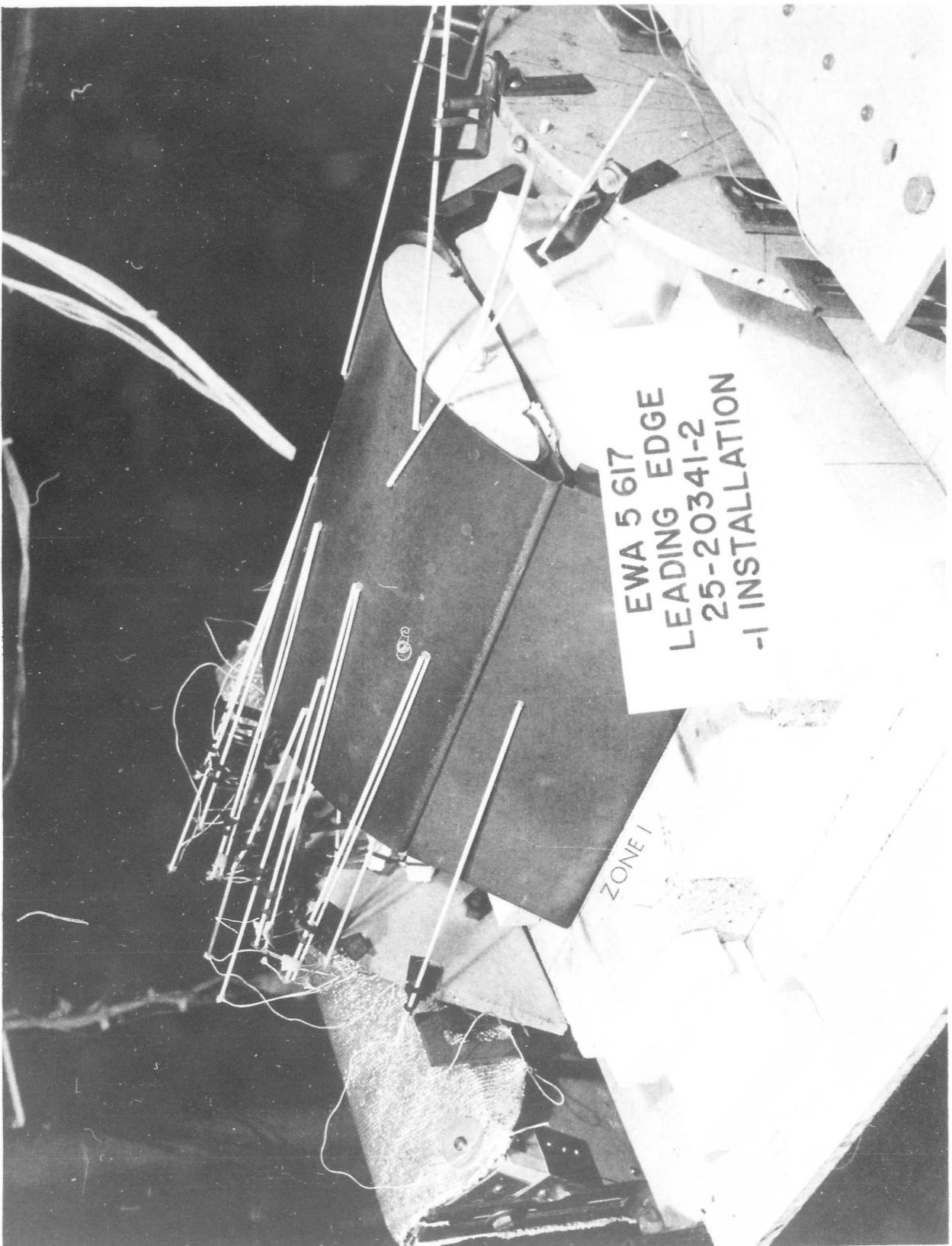
25-20341-2

BOEING

NO. D2-80085

Fig. 3-78

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25-20341-2 AFTER HEAT TEST

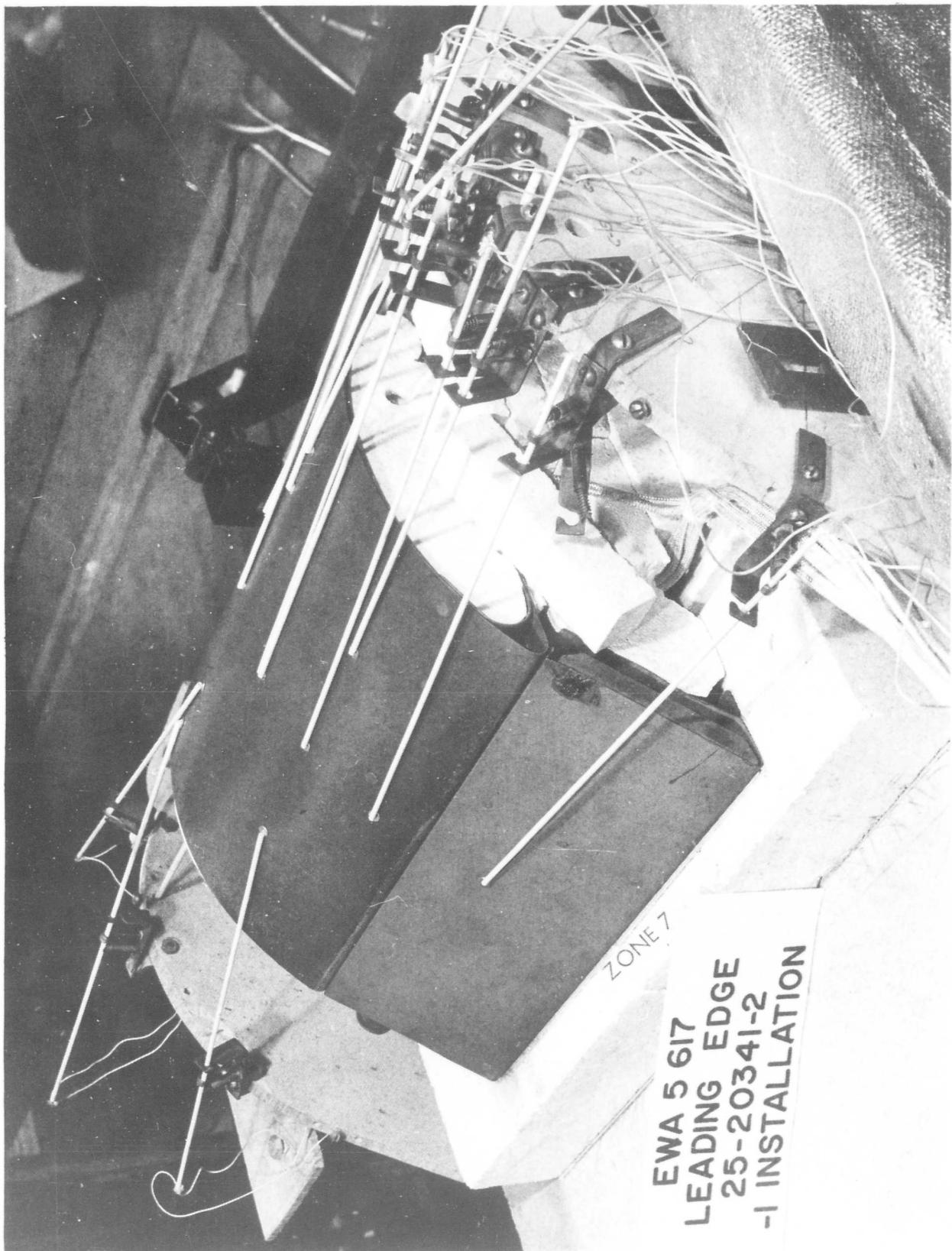
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BOEING

NO.D2-0015

Fig. 3-79

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25-20341-2 AFTER HEAT TEST

U3-4071-1000 (was BAC 1546-L-R3)

1000-3-103

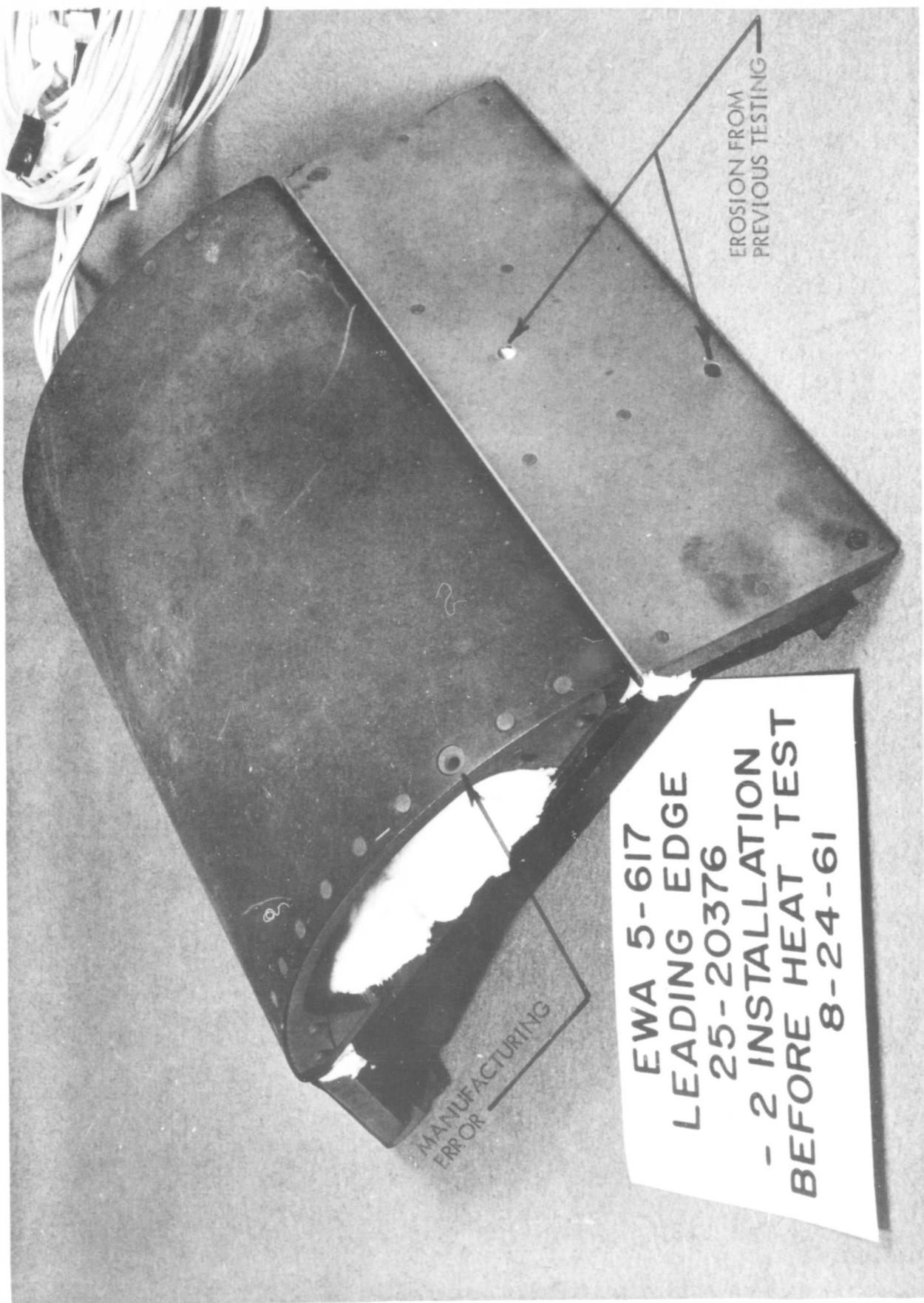
BOEING

NO. D2-0085

Fig. 3-80

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25-20376-I BEFORE HEAT TEST

U3-4071-1000 (was BAC 1546-L-R3)

9-2-63

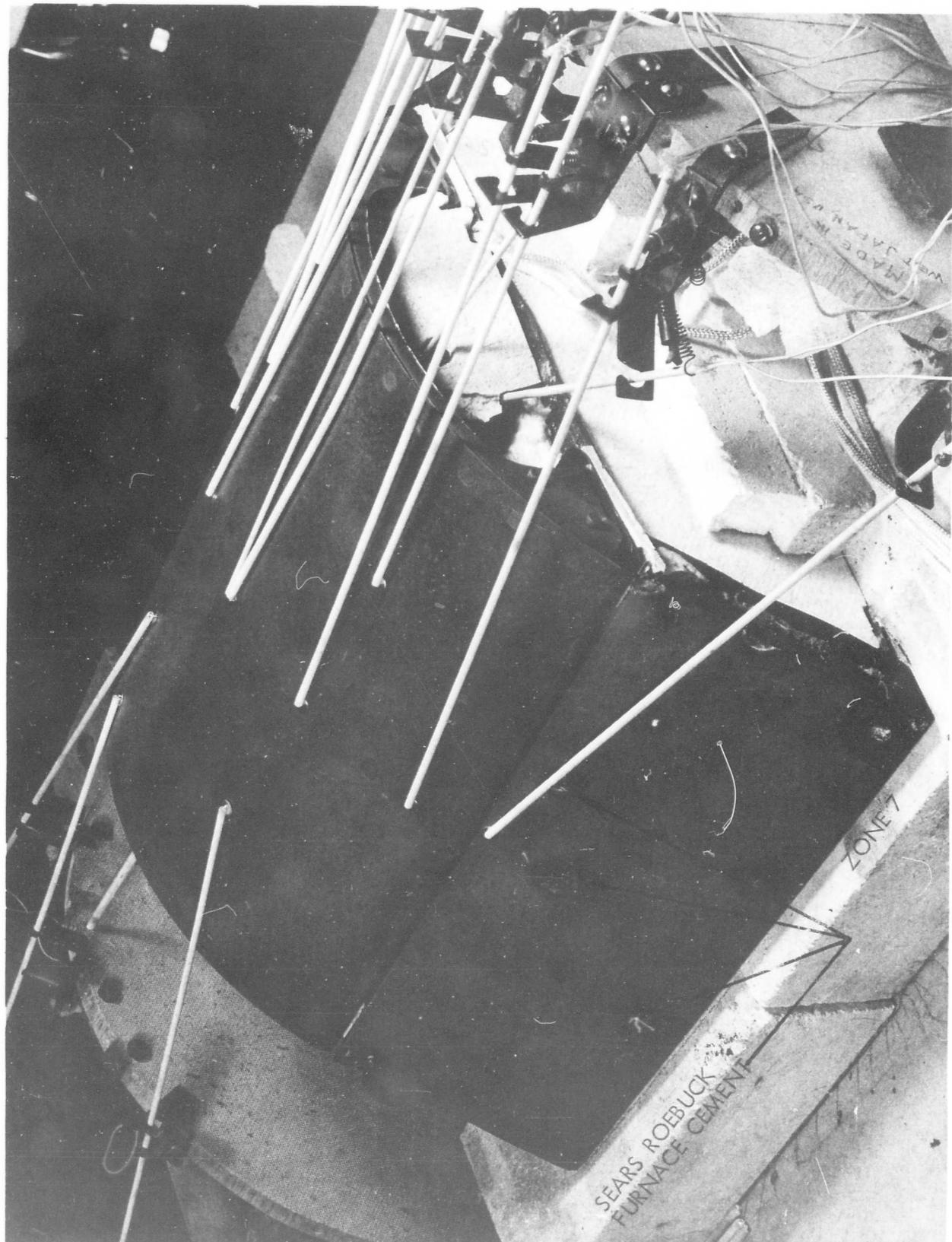
BOEING

NO. D2-5051

Volume I Fig. 3-81

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25-20376-1 AFTER HEAT TEST

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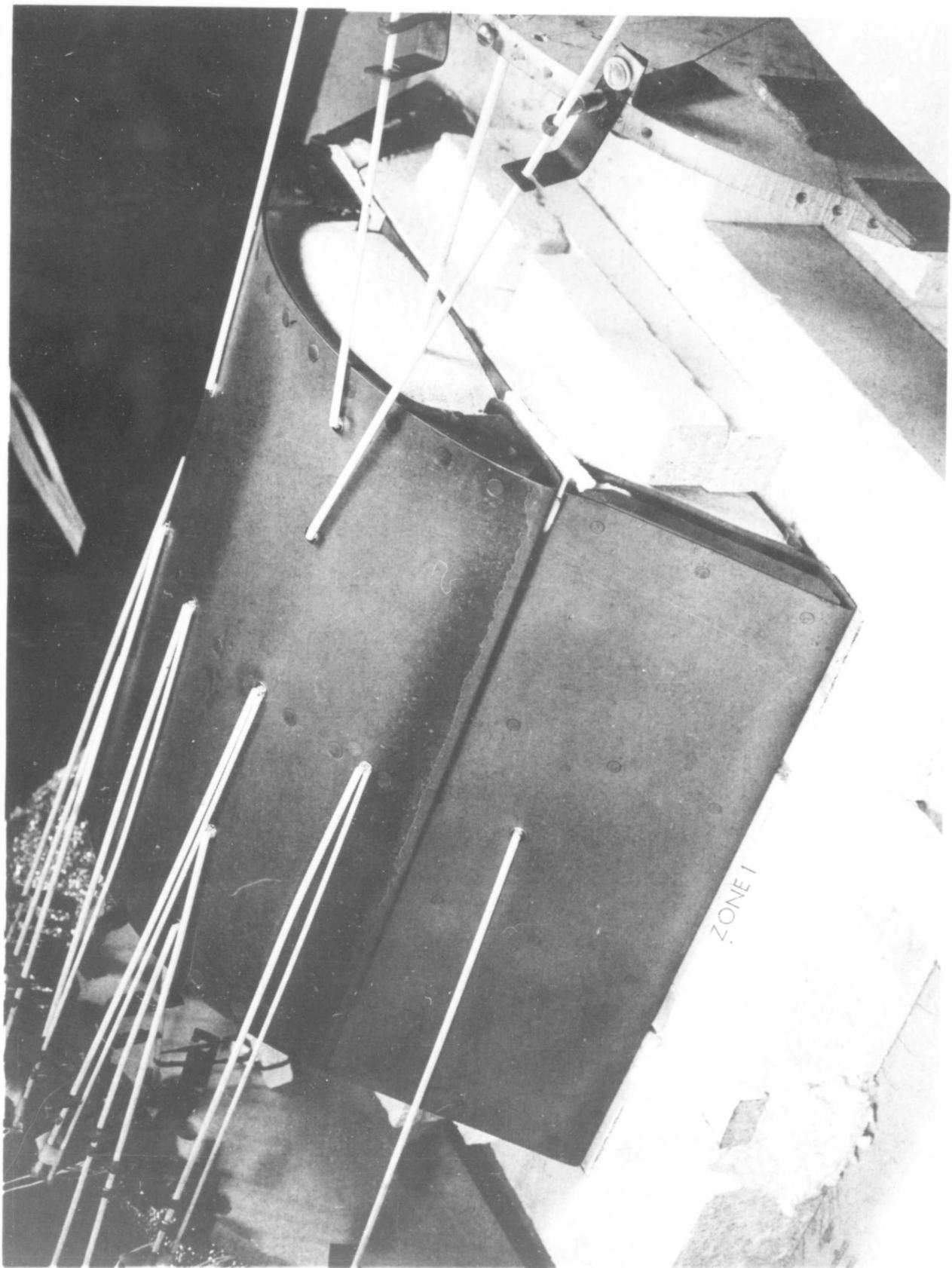
BOEING

NO. D2-300-4

Vol. 1 Fig. 3-82

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25-20376-I AFTER HEAT TEST

U3-4071-1000 (was BAC 1546-L-R3)

9-8-61

Volume 12 Fig. 3-83 PAGE 3-101

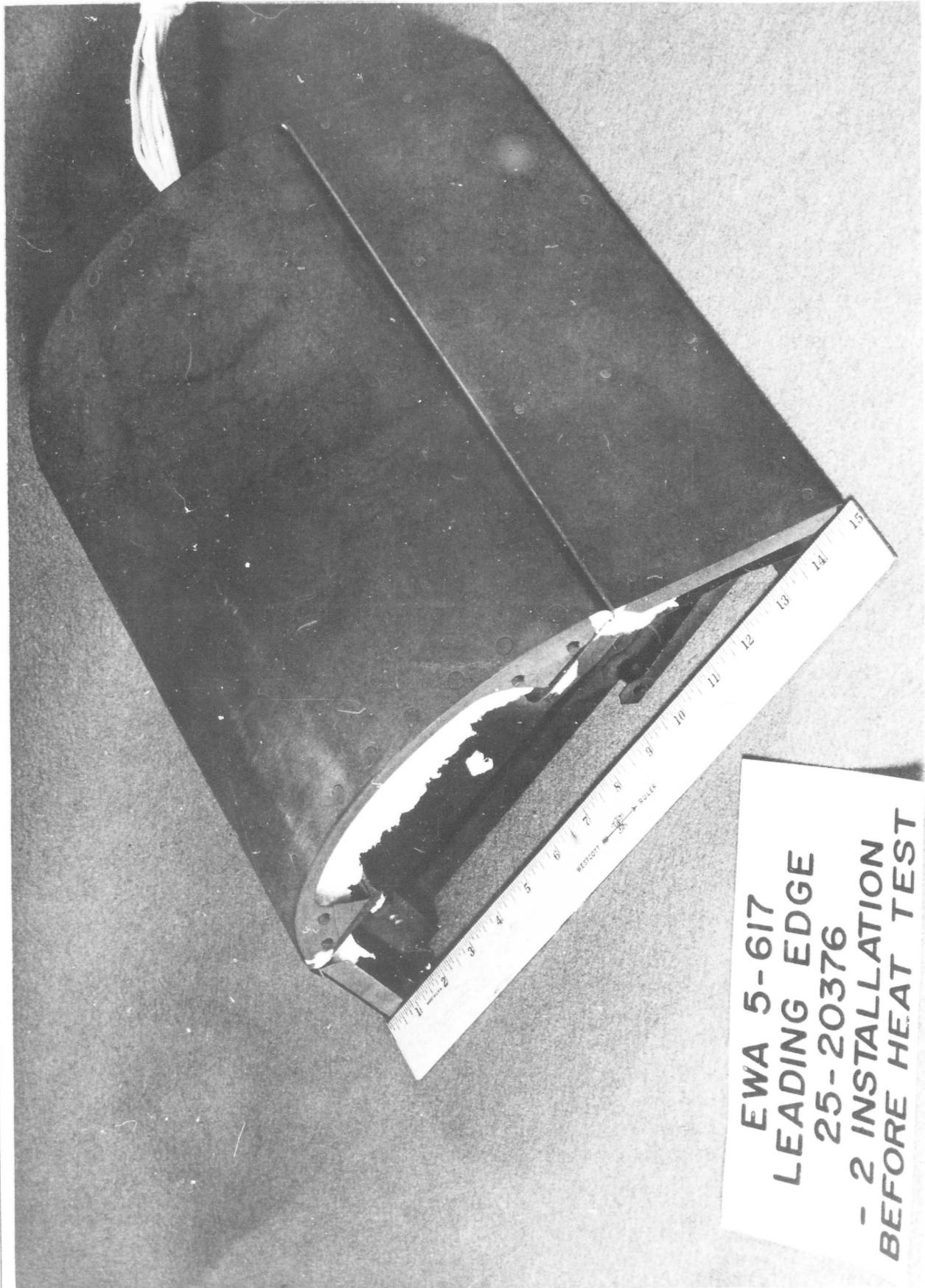
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NO. D2-1000



2A68169

DTA50AR LEADING EDGE EWA 5-617 - INSTALLATION  
BEFORE HEAT TEST 9-11-61



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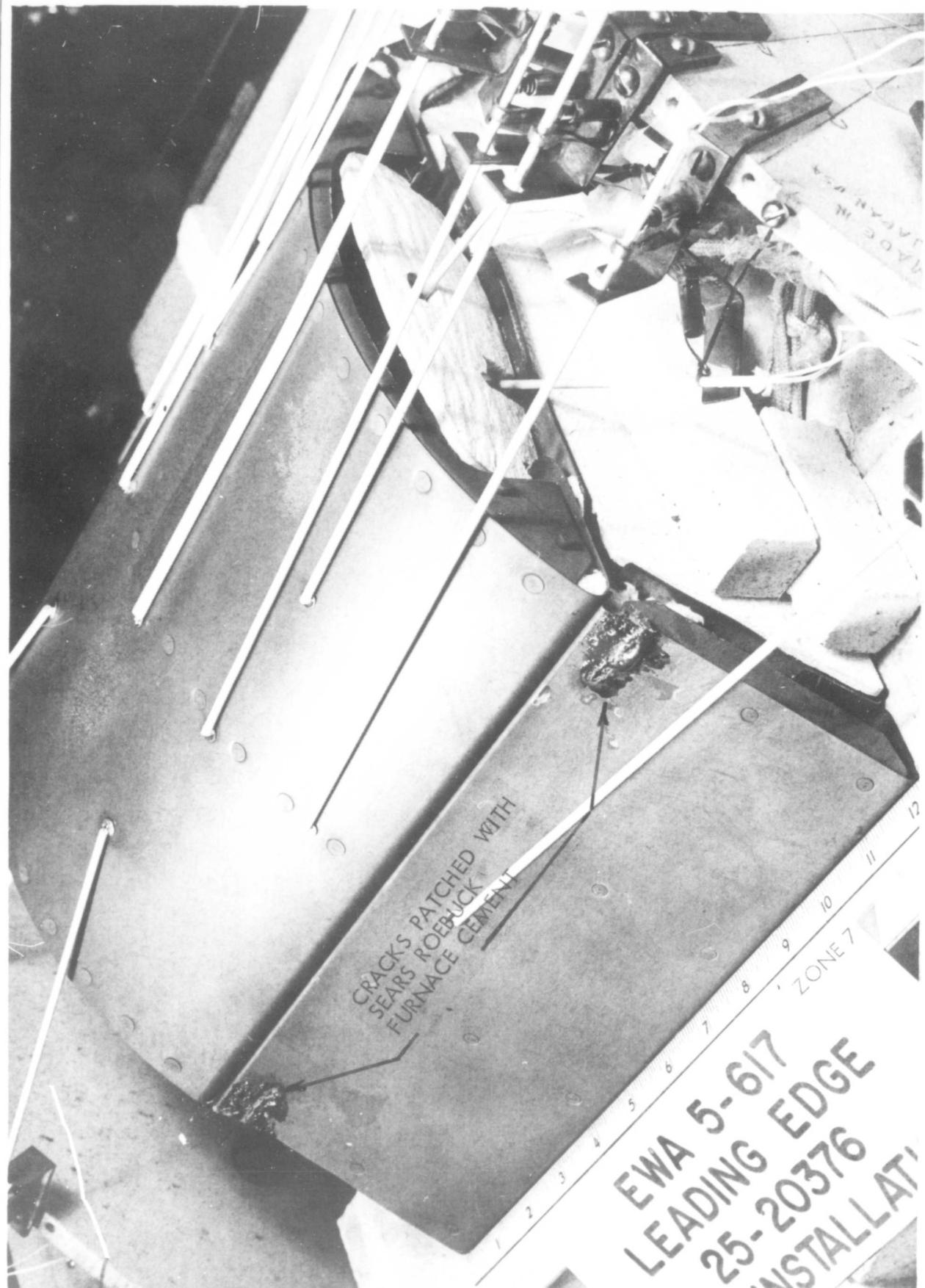
25-20376-2 BEFORE HEAT TEST

BOEING

NO. D2-30015

Fig. 3-84

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25-20376-2 AFTER HEAT TEST

BAC 1546 L-R3

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BOEING

NO. D2-0001

Volume I Fig. 3-85

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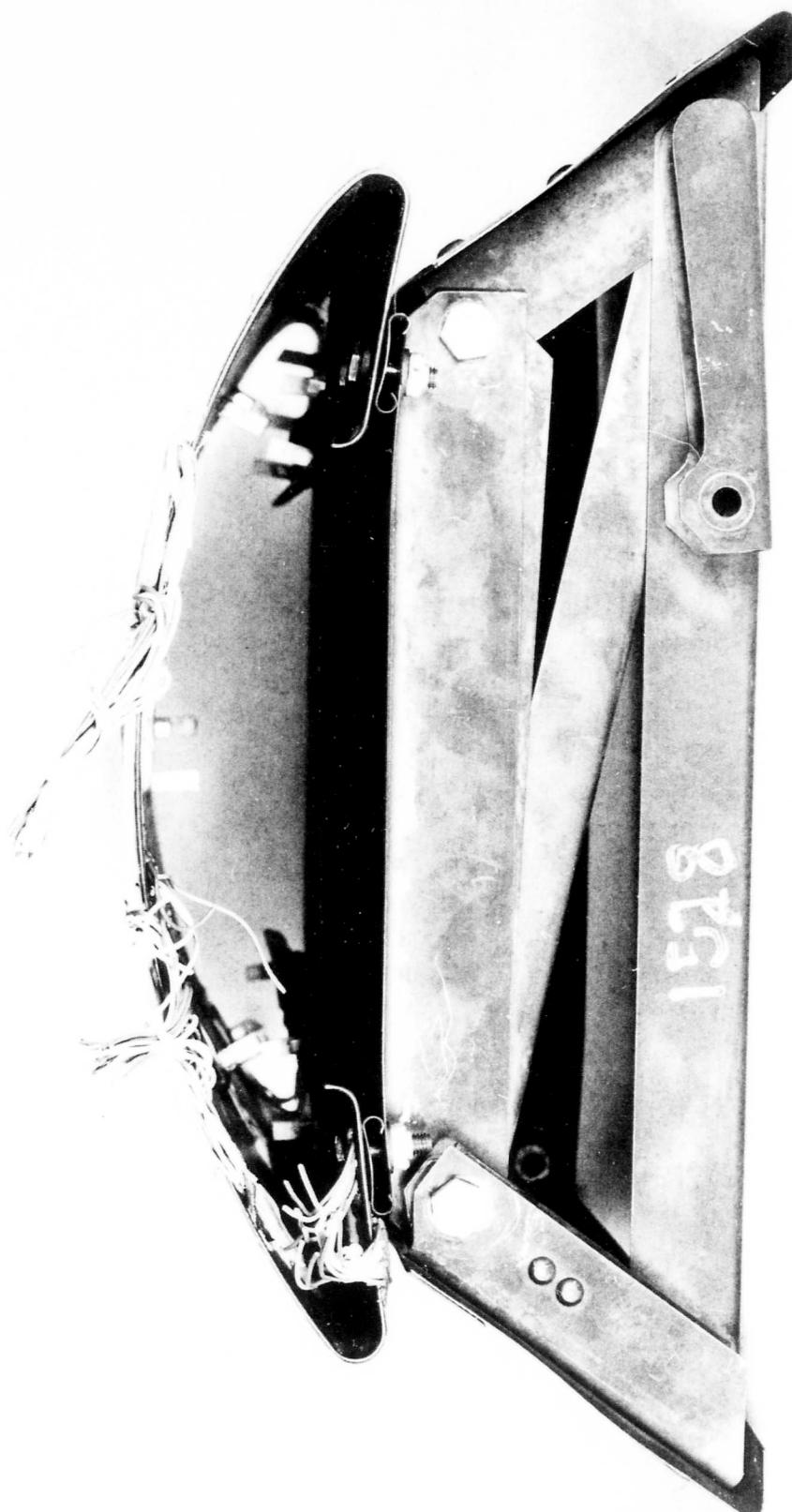


25-20376-2 AFTER HEAT TEST

BAC 1546 L-R3

Q-3-03

BOEING NO. D2-300-  
Volume I, Fig. 3-86 PAGE 3-104



25-20372-1 SLOW-LOAD TESTED

U3-4071-1000 (was BAC 1546-L-R3)

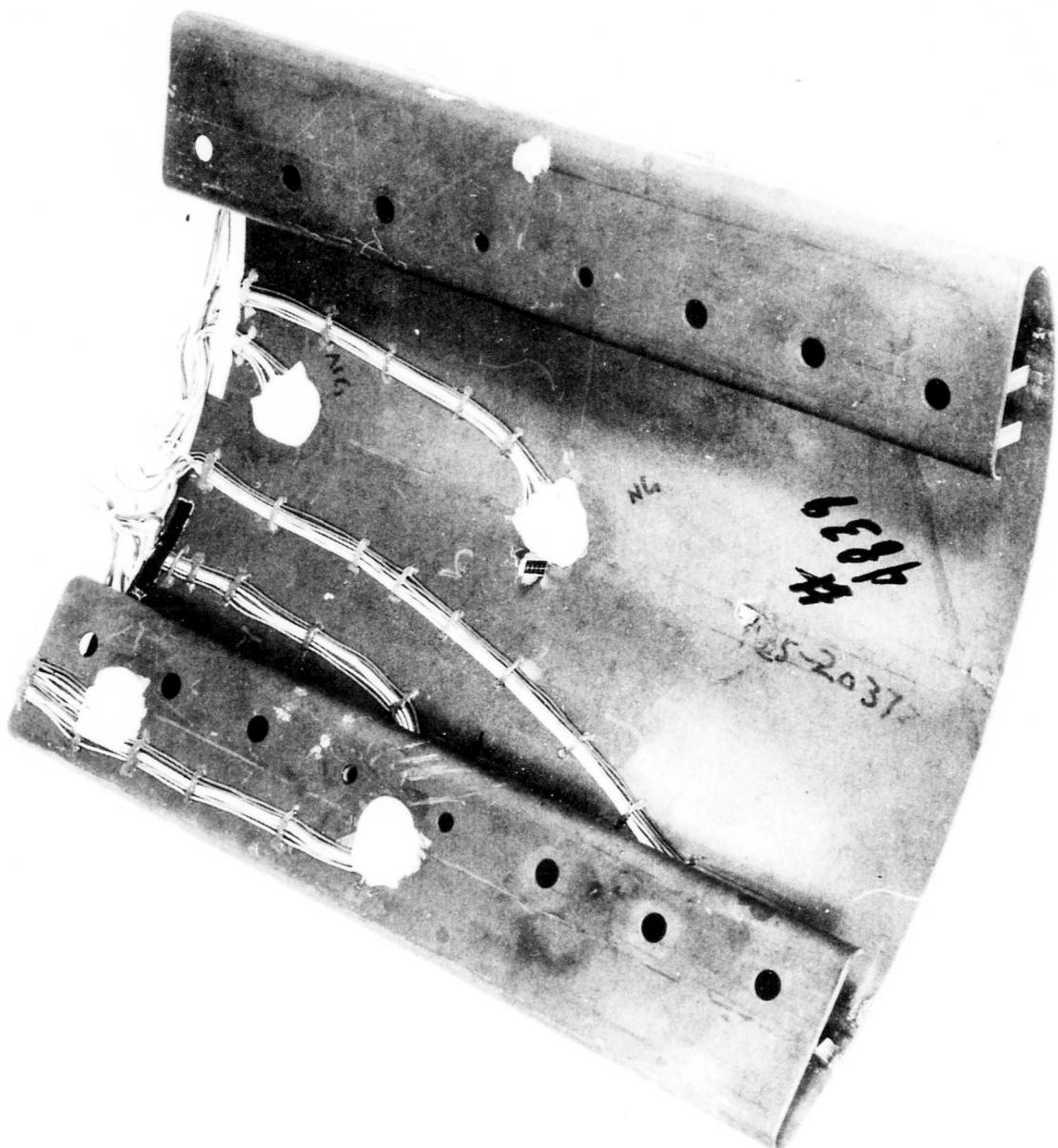
BOEING

NO. D2-80085

Volume D Fig. 3-87

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25-2037-1 SLOW-LOAD TESTED

U3-4071-1000 (was BAC 1546-L-R3)

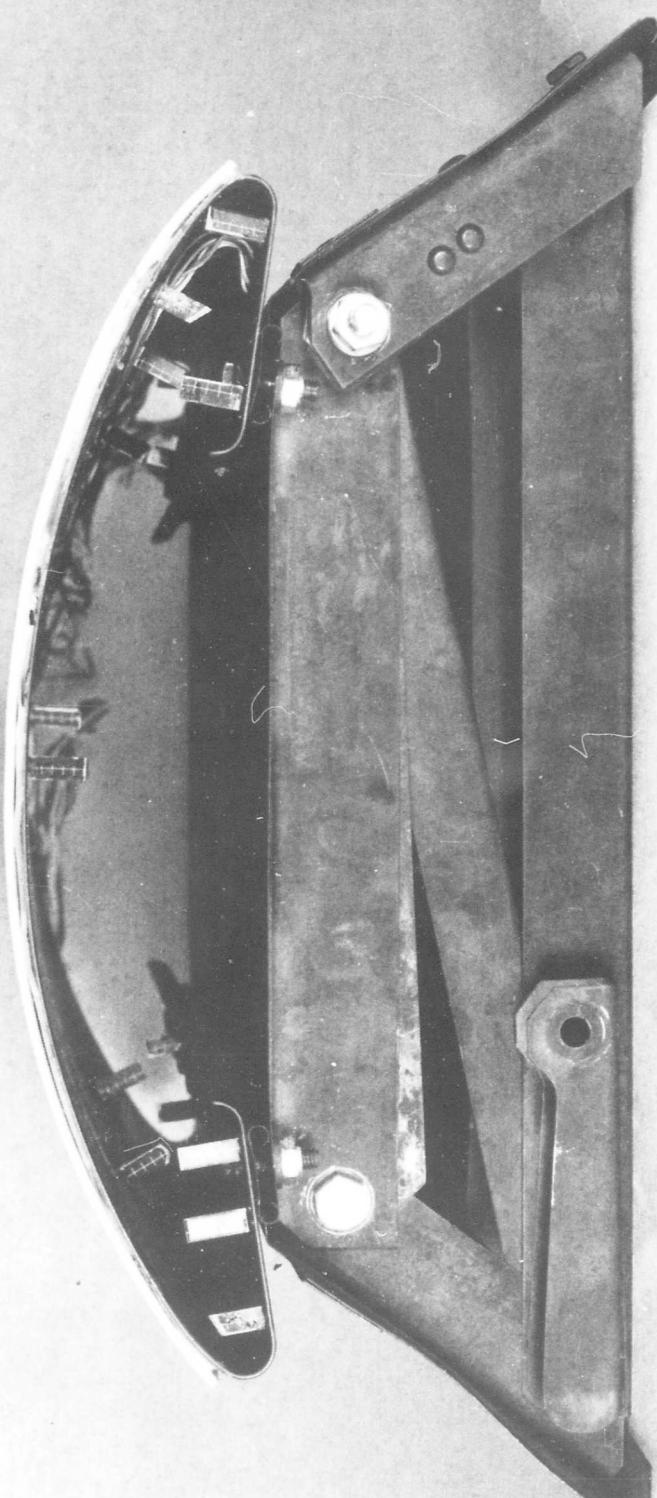
BOEING | NO. D2-80085

Volume 2 Fig. 3-88 | PAGE 3-106



1-17-62

RC-20372



25-20372-I SLOW-LOAD TESTED

U3-4071-1000 (was BAC 1546-L-R3)

NO. D2-80085

BOEING

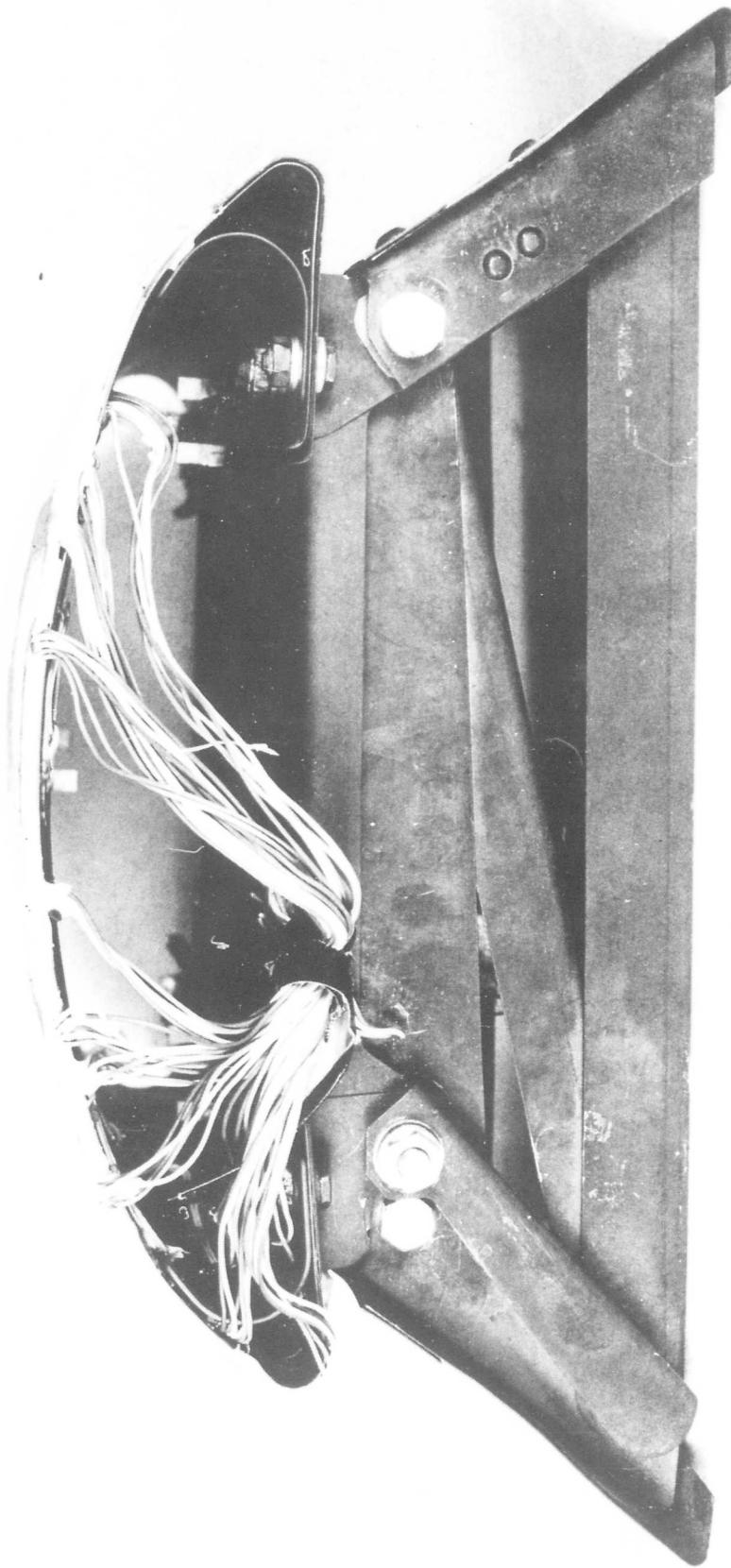
Volume I Fig. 3-89

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DS-I LEADING EDGE FAILURES  
#5-20367 1-17-62

2A96278



25-20367-I SLOW-LOAD TESTED

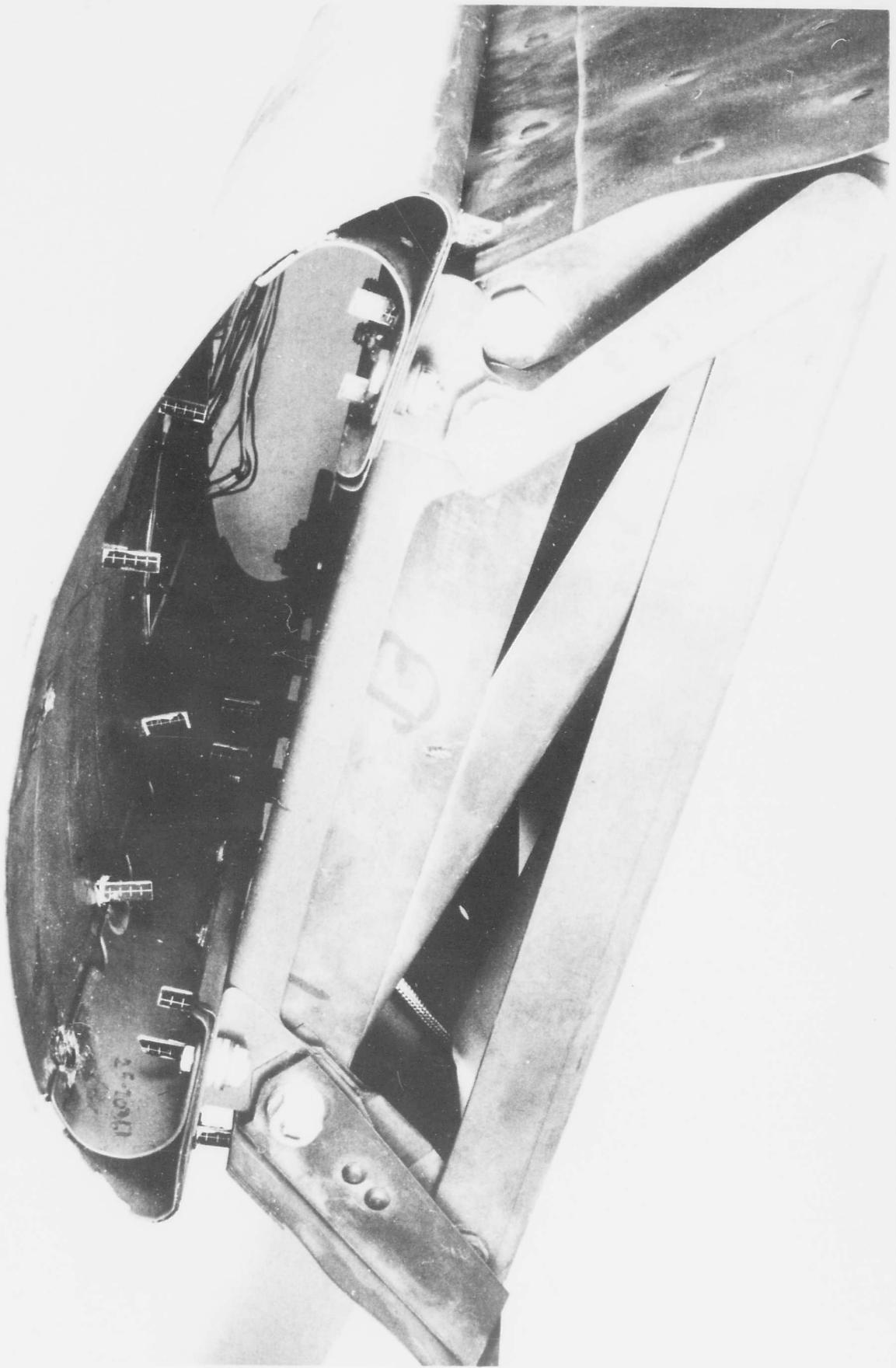
U3-4071-1000 (was BAC 1546-L-R3)

BOEING

no. D2-80085

Volume 7 Fig. 3-90

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25-20367-I SLOW-LOAD TESTED

U3-4071-1000 (was BAC 1546-L-R3)

NO. D2-80085

BOEING

Volume 2

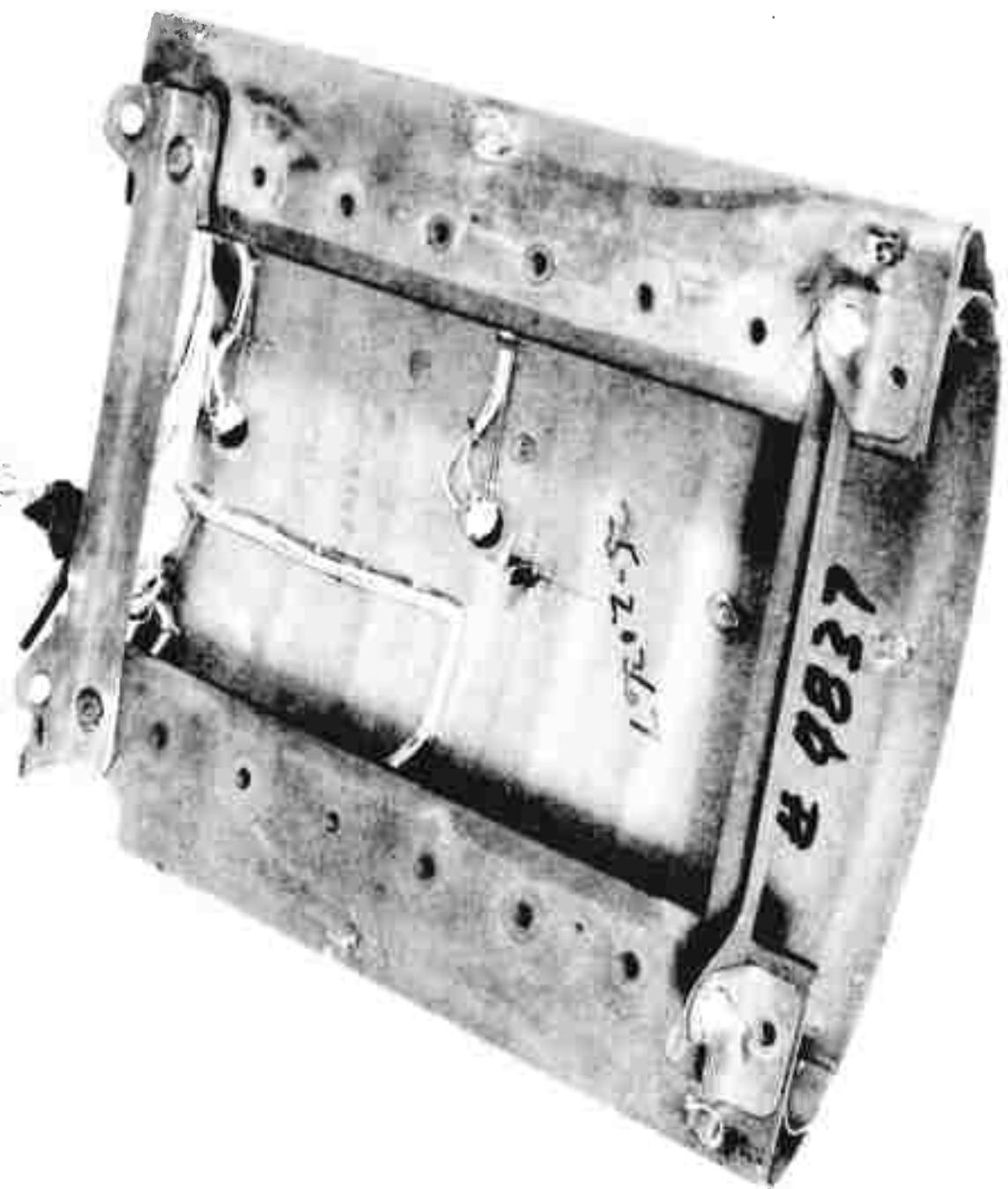
Fig. 3-91

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DS-1 FAILED LEADING EDGE SECTION 25-20367  
25-20366 1-30-62

25-20366

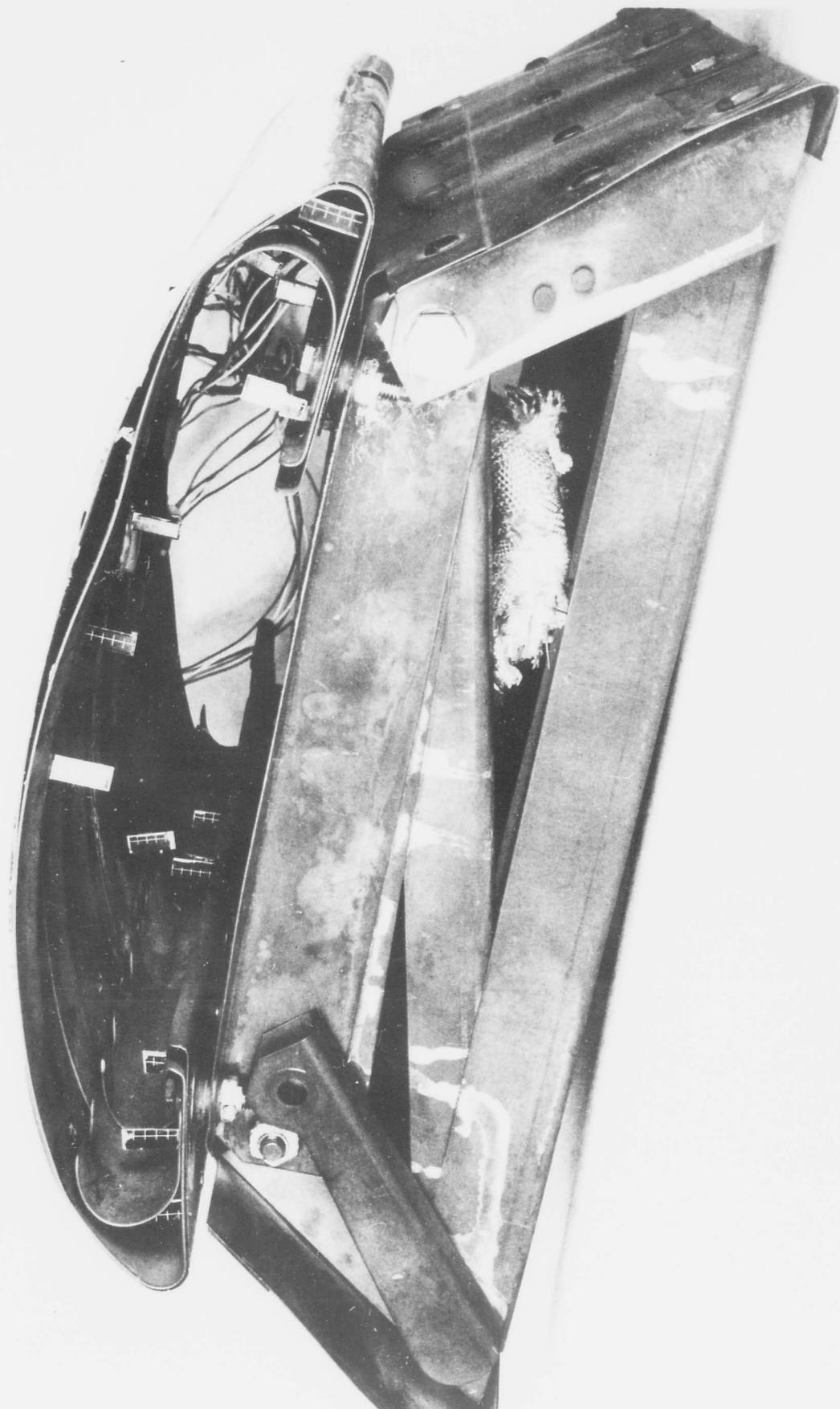


25-20367-1 SLOW-LOAD TESTED

U3-4071-1000 (wes BAC 1546-L-R3)

BOEING NO. D2-80085

Volume I Fig. 3-92 PAGE 3-110



25-20378-1 SLOW-LOAD TESTED

U3-4071-1000 (was BAC 1546-L-R3)

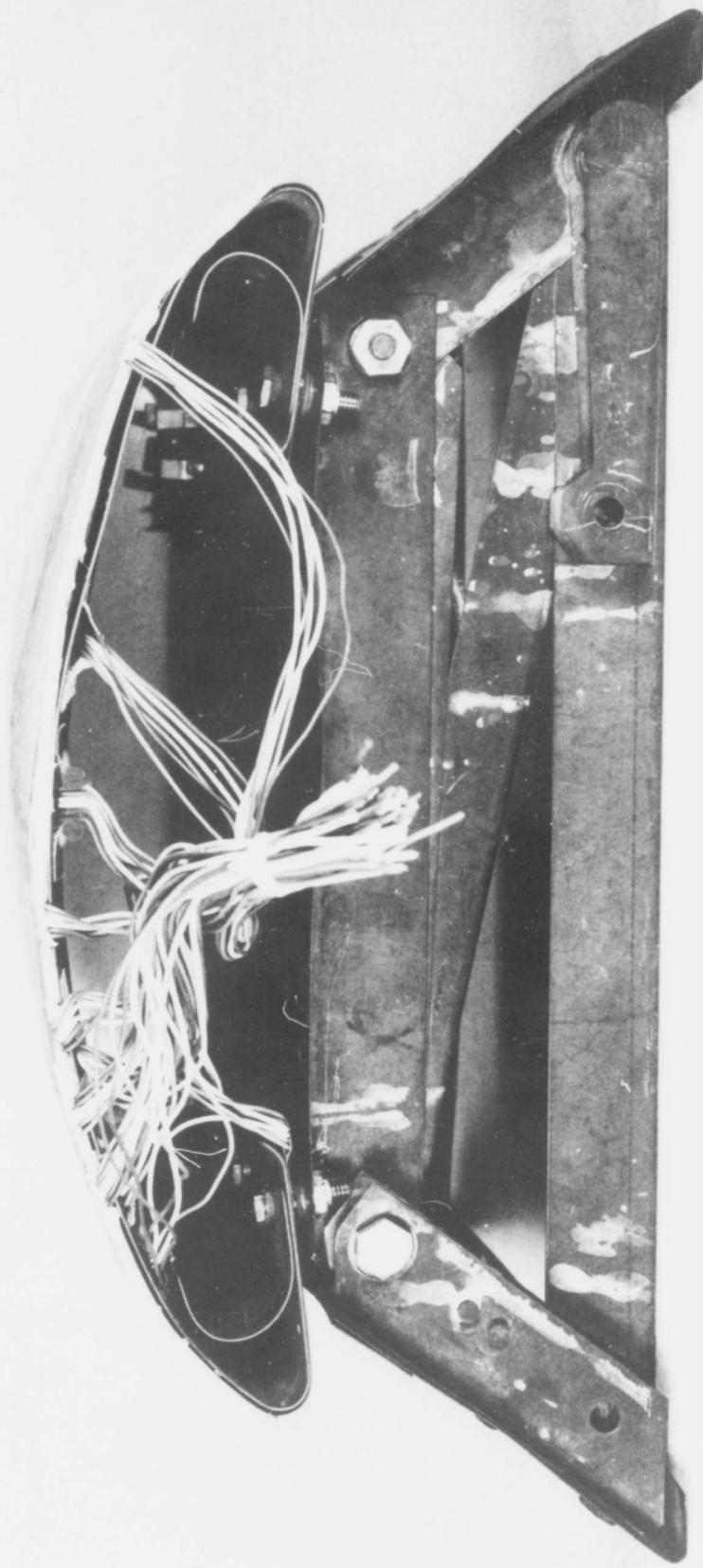
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BOEING NO. D2-80085  
Fig. 3-93 PAGE 3-III

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25-20378-I SLOW-LOAD TESTED

U3-4071-1000 (was BAC 1544-L-R3)

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Volume I

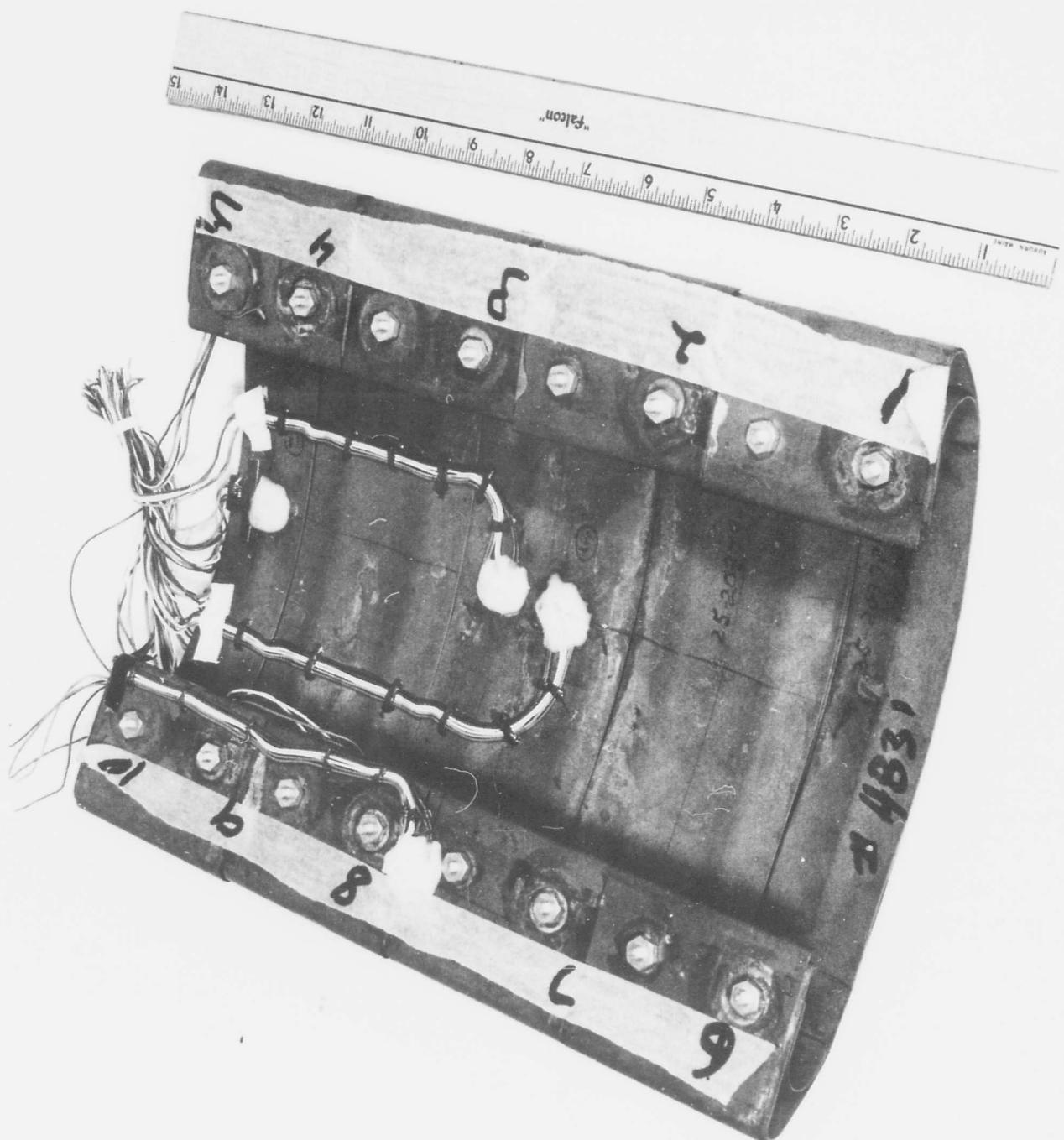
BOEING

NO. D2-80085

Fig. 3-94

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25-20378-1 SLOW-LOAD TESTED

U3-4071-1000 (was BAC 1546-L-R3)

BOEING

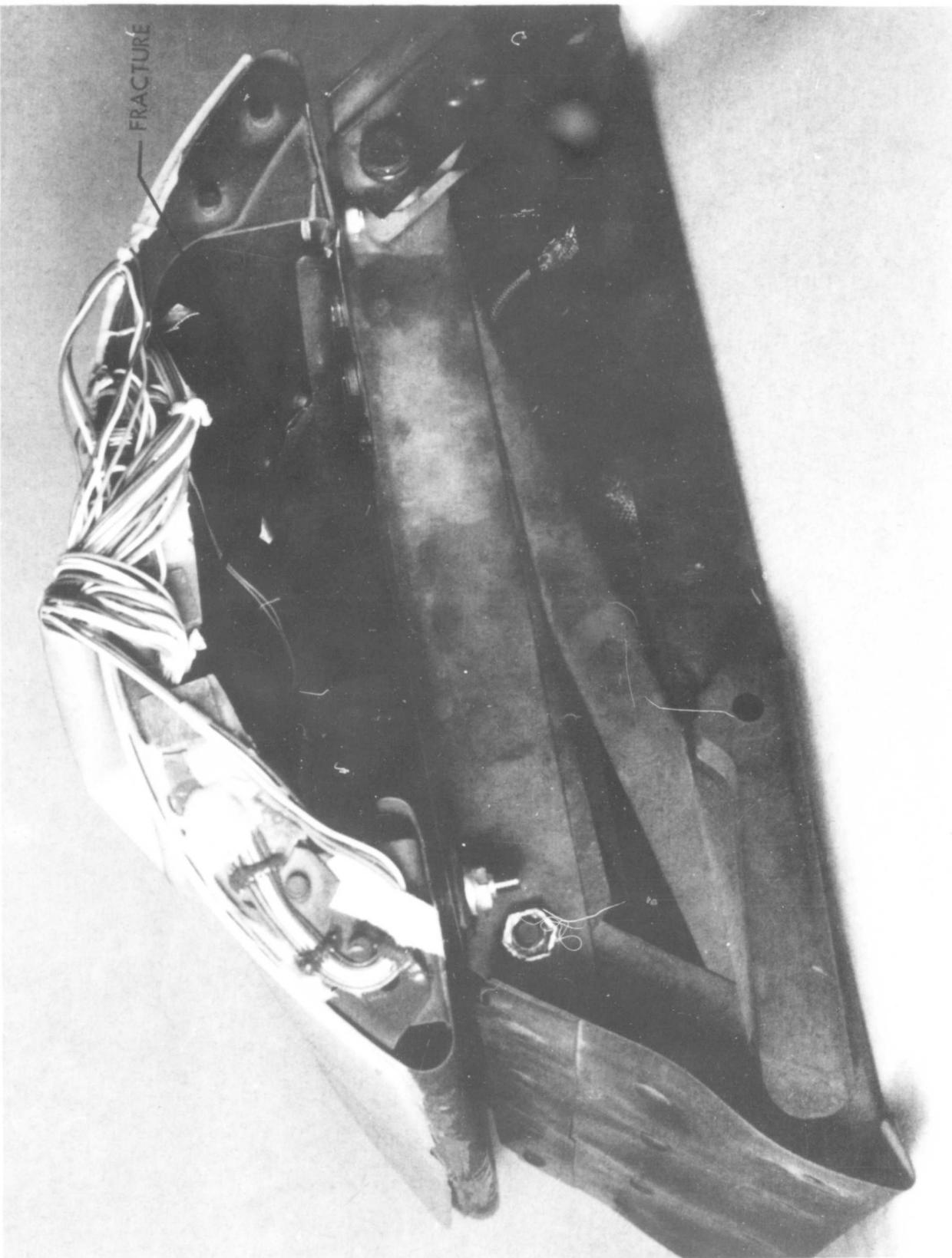
NO. D2-80085

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Fig. 3-95

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25-20376-1 SLOW LOAD TESTED

U3-4071-1000 (was BAC 1546-L-R3)

NO. D2-80085

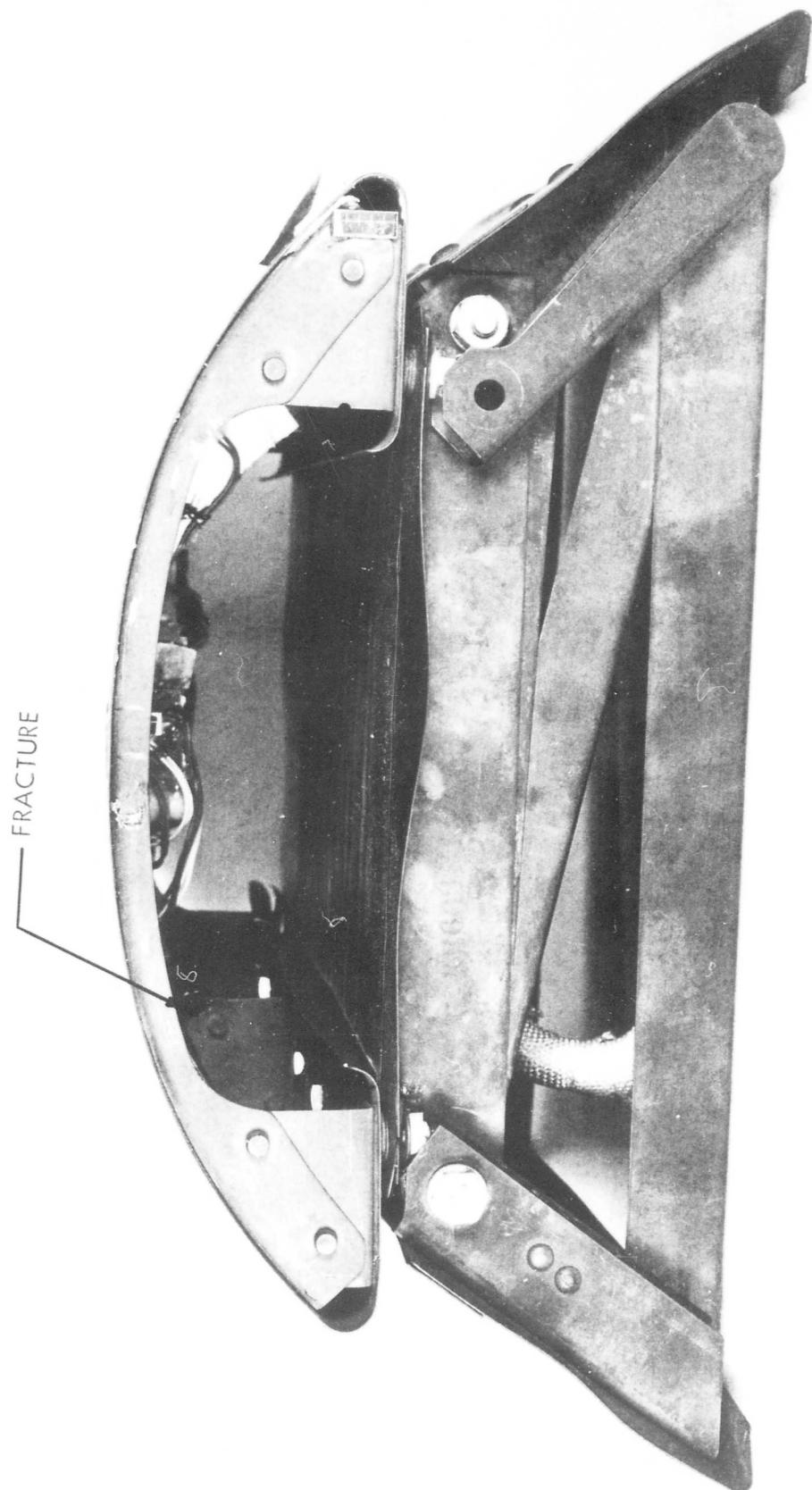
BOEING

Fig. 3-96

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25-20376-1 SLOW-LOAD TESTED

U3-4071-1000 (was BAC 1546-L-R3)

NO. D2-80085

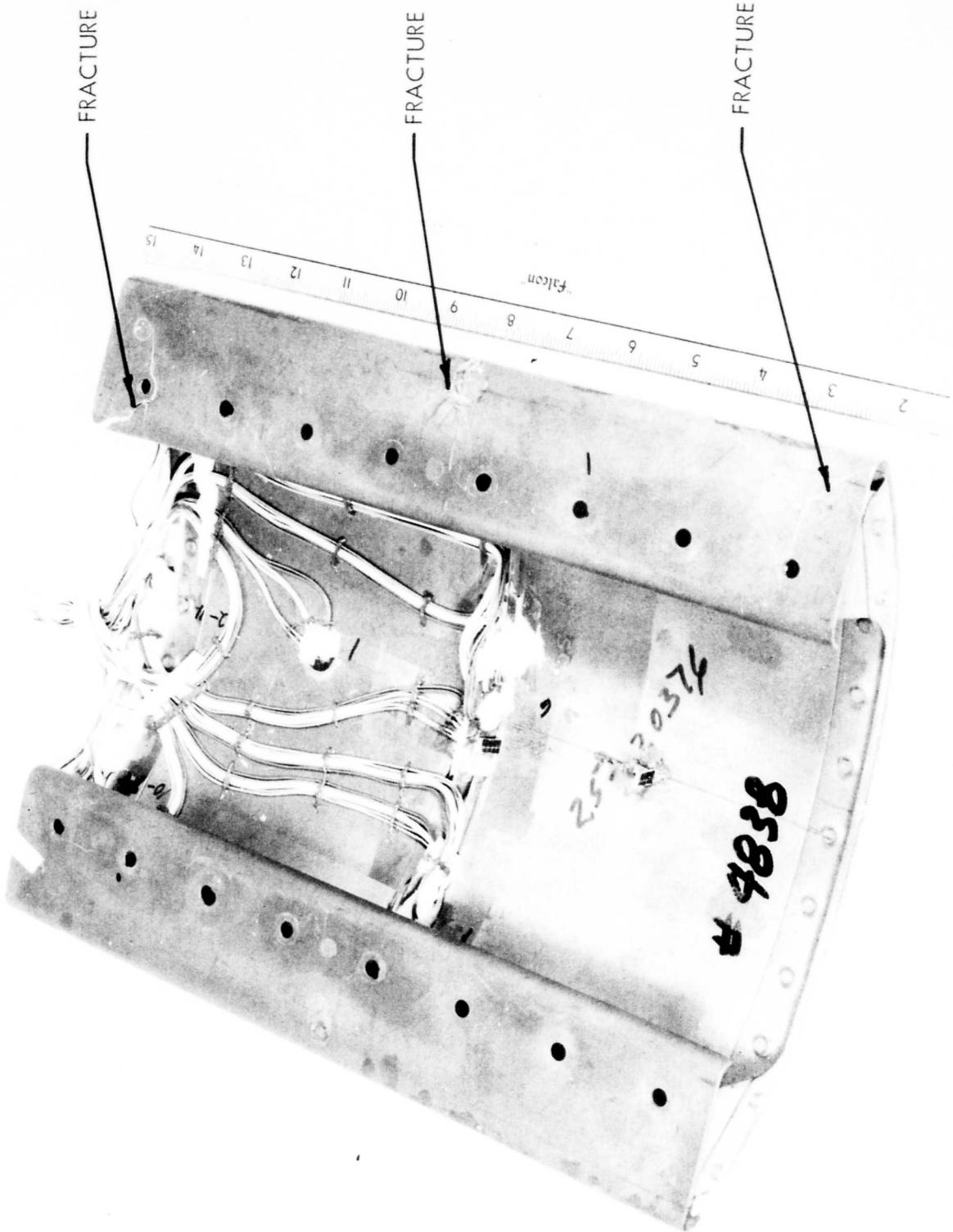
BOEING

Volume I

Fig. 3-97

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25-20376-I SLOW-LOAD TESTED

U3-4071-1000 (was BAC 1546-L-R3)

BOEING

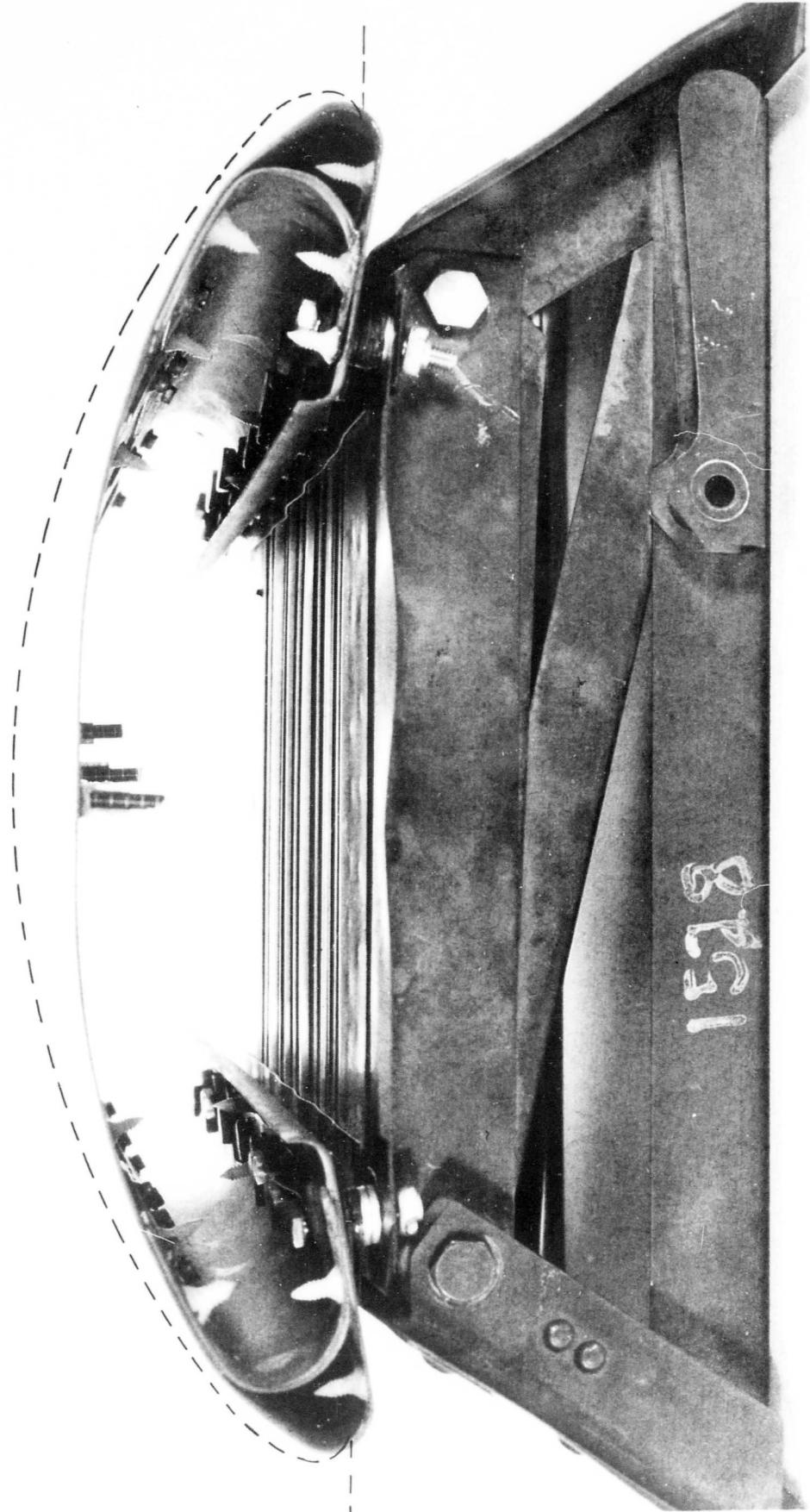
NO. D2-80085

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Fig. 3-98

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APPROXIMATE ORIGINAL CONTOUR



25-20341-1 SLOW-LOAD TESTED

U3-4071-1000 (was BAC 1546-L-R3)

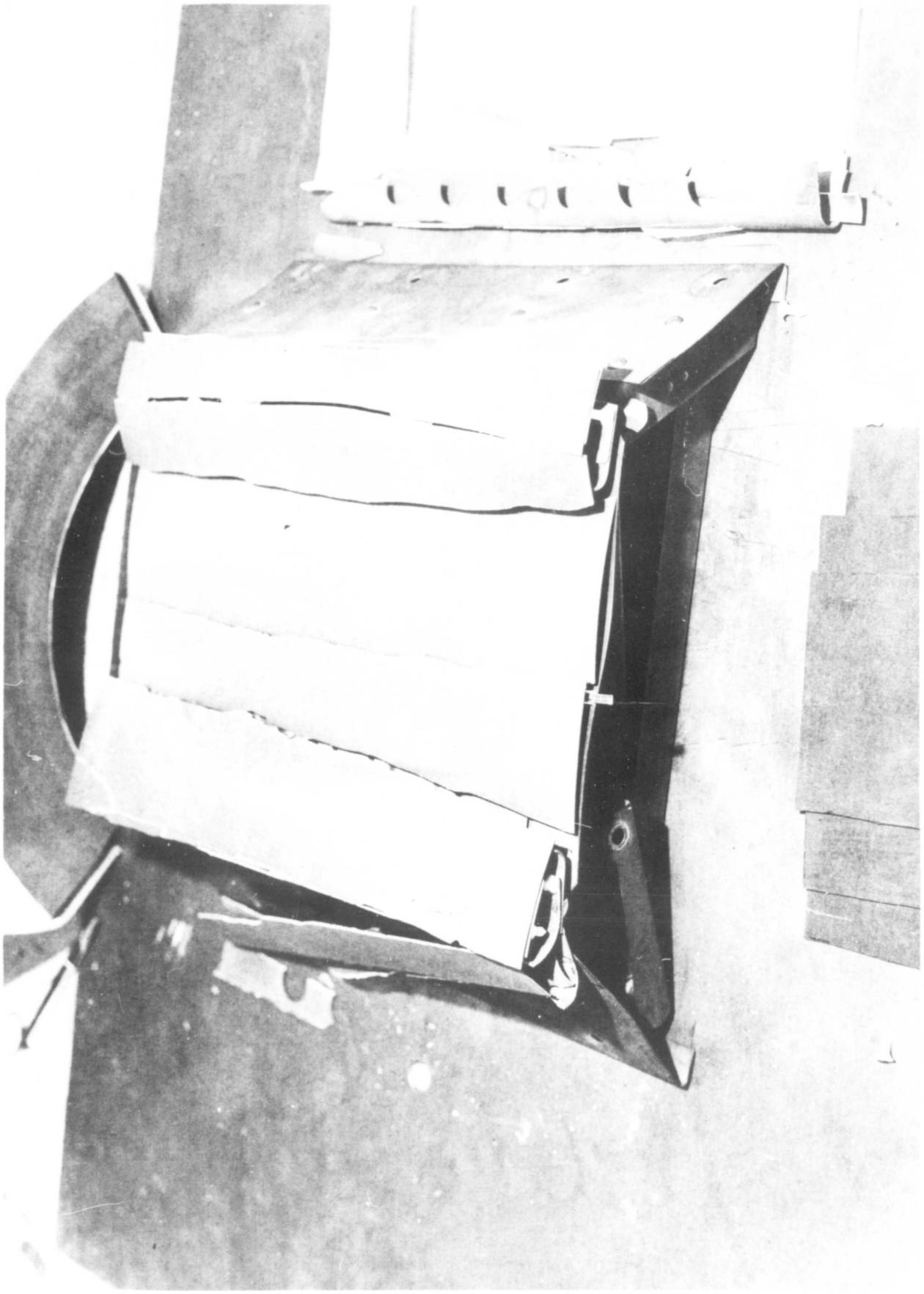
BOEING

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Volume 2 Fig. 3-99

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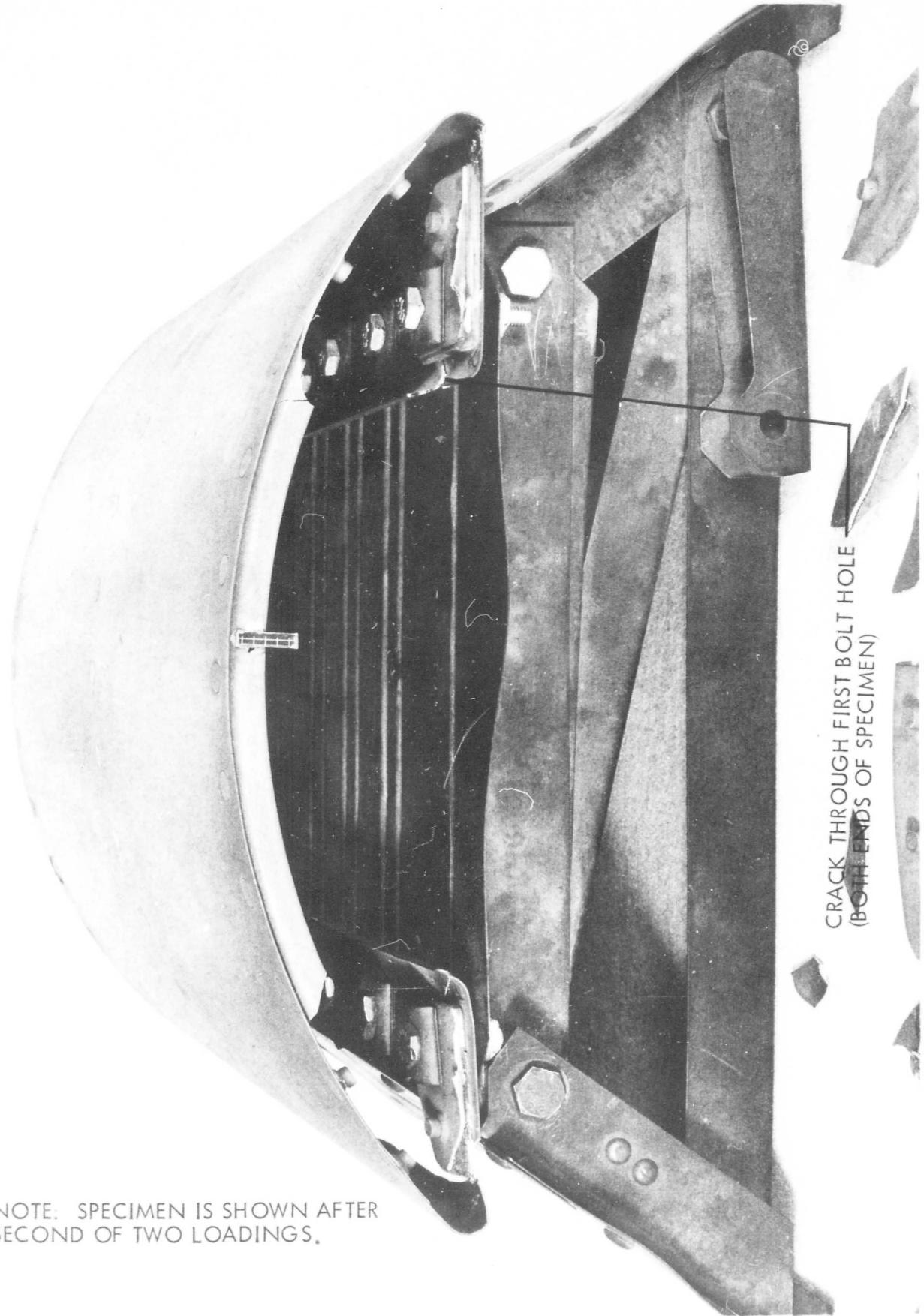


25-20341-2 RAPID-LOAD TESTED

U3-4071-1000 (was BAC 1546-L-R3)

BOEING | NO. D2-80085  
Volume I Fig. 3-100 PAGE 3-113





NOTE: SPECIMEN IS SHOWN AFTER  
SECOND OF TWO LOADINGS.

25-20376-2 RAPID-LOAD TESTED

U3-4071-1000 (was BAC 1546-L-R3)

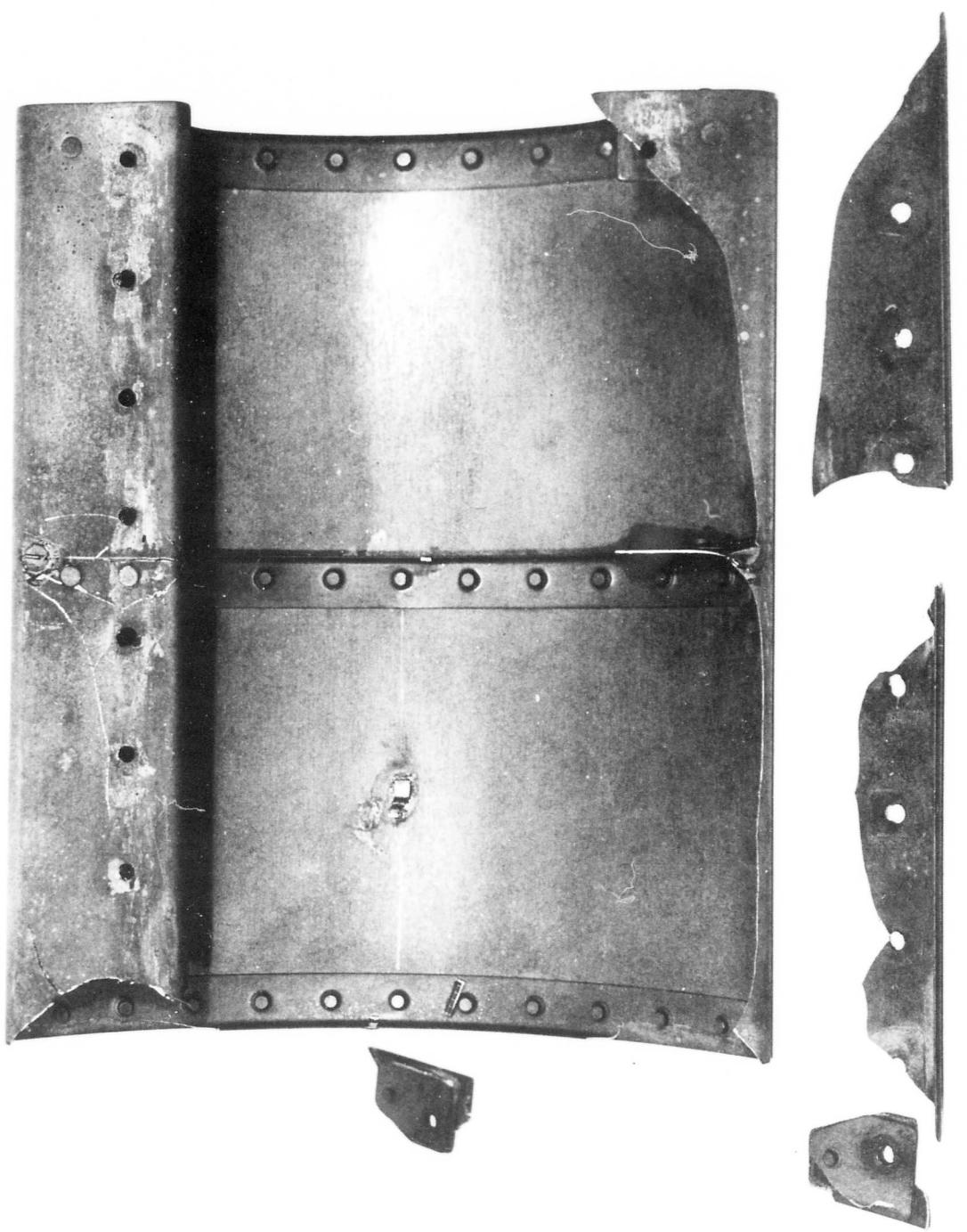
BOEING

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25-20376-2 RAPID-LOAD TESTED

U3-4071-1000 (was BAC 1546-L-R3)

BOEING

NO. D2-80085

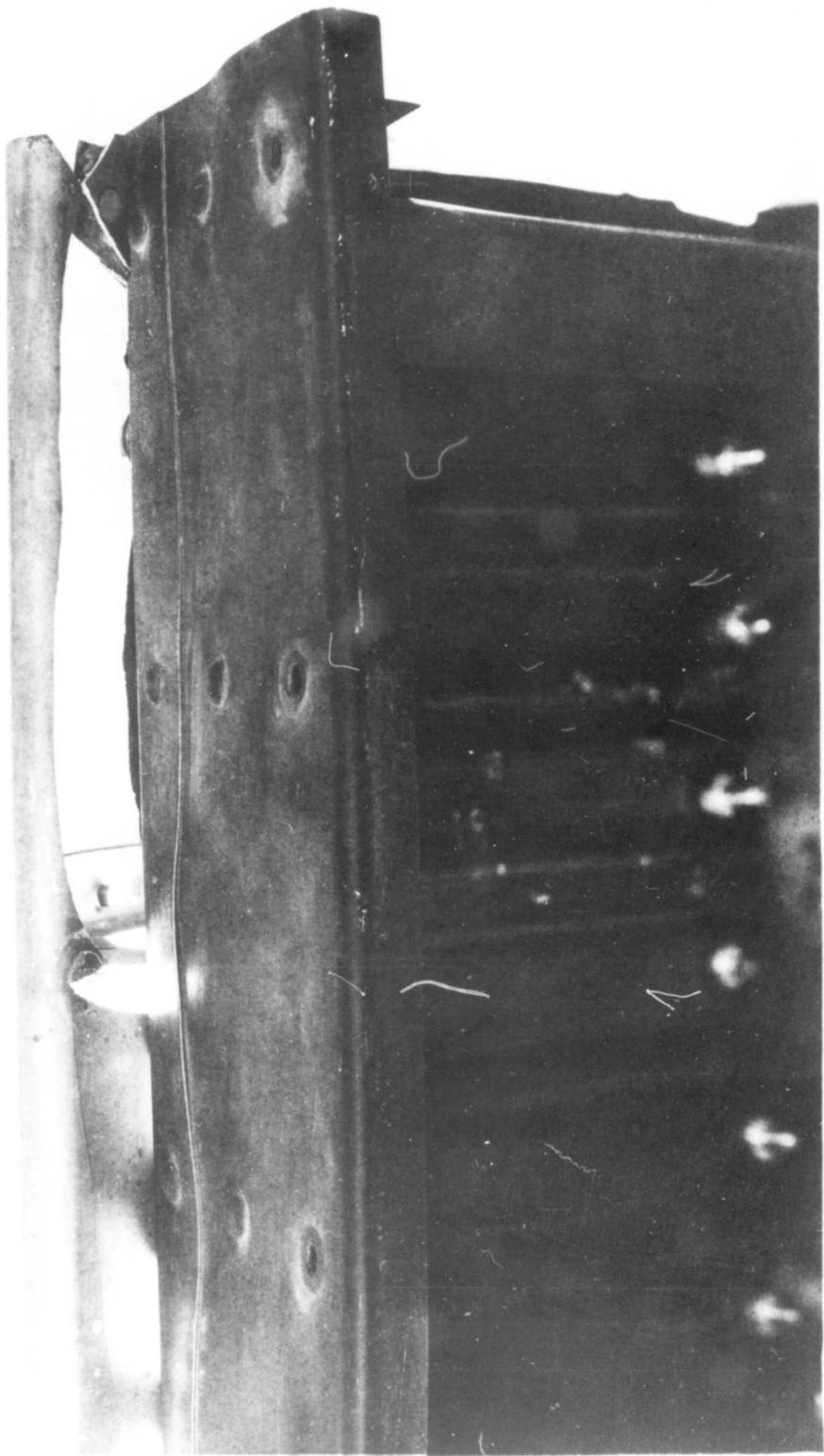
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Fig. 3-102

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25-20376-2 RAPID-LOAD TESTED

U3-4071-1000 (was BAC 1546-L-R3)

BOEING

NO. D2-80085

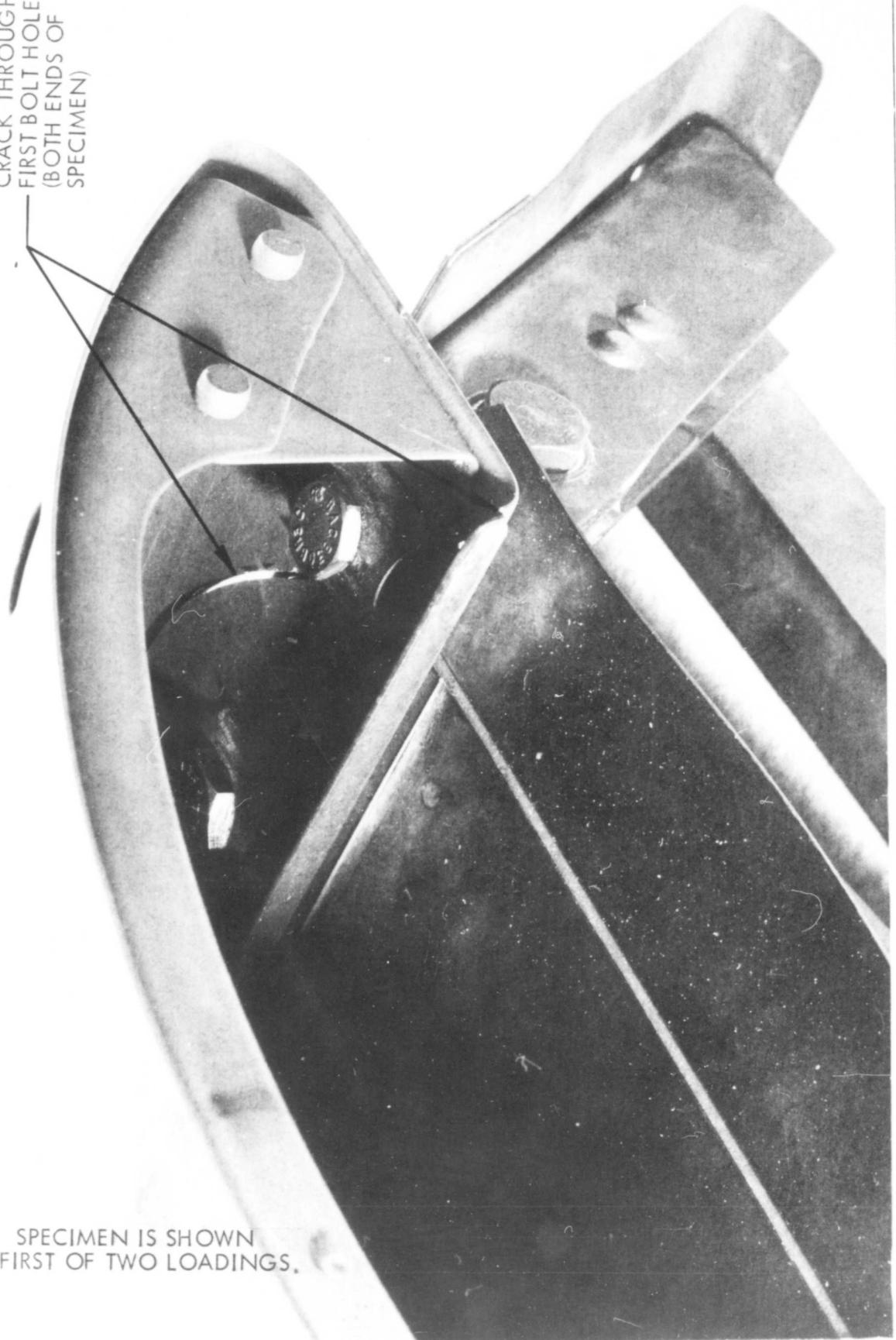
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Fig. 3-103

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CRACK THROUGH  
FIRST BOLT HOLE  
(BOTH ENDS OF  
SPECIMEN)



NOTE: SPECIMEN IS SHOWN  
AFTER FIRST OF TWO LOADINGS.

25-20376-2 RAPID-LOAD TESTED

U3-4071-1000 (was BAC 1546-L-R3)

NO. D2-80085

BOEING

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| CALC  |  | REVISED | DATE |
|-------|--|---------|------|
| CHECK |  |         |      |
| APPD  |  |         |      |
| APPD  |  |         |      |

X-RAY OF LEADING EDGE  
SPECIMEN 25-20372 AFTER TEST  
DS-1 LEADING EDGE LOAD TESTS

BOEING AIRPLANE COMPANY Fig. 3-105

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| CALC  |  |  | REVISED | DATE |
|-------|--|--|---------|------|
| CHECK |  |  |         |      |
| APPD  |  |  |         |      |
| APPD  |  |  |         |      |

X-RAY OF LEADING EDGE  
SPECIMEN 25-20367 AFTER TEST  
DS-1 LEADING EDGE LOAD TESTS

D2-80085  
PAGE  
3-124

BOEING AIRPLANE COMPANY  
Fig. 3-106

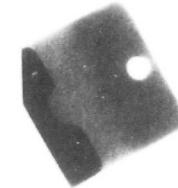
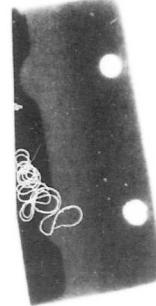
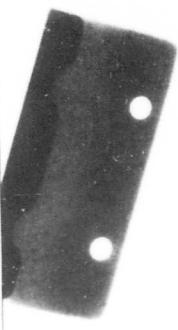
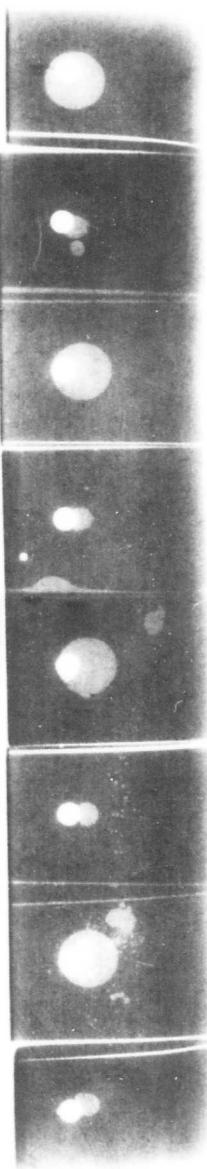
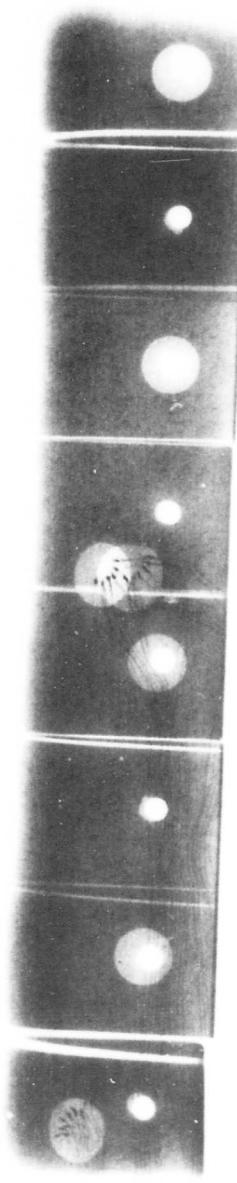
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|-------|--|---------|------|
| CHECK |  |         |      |
| APPD  |  |         |      |
| APPD  |  |         |      |

X-RAY OF LEADING EDGE  
SPECIMEN 25-20378 AFTER TEST  
DS-I LEADING EDGE LOAD TESTS

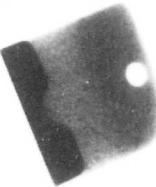
D2-80085

BOEING AIRPLANE COMPANY  
Fig. 3-107

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3-125



4881  
13121  
12116



| CALC  |  |  | REVISED | DATE |
|-------|--|--|---------|------|
| CHECK |  |  |         |      |
| APPD  |  |  |         |      |
| APPD  |  |  |         |      |

X-RAY OF LEADING EDGE  
SPECIMEN 25-20378 AFTER TEST  
DS-I LEADING EDGE LOAD TESTS

D2-80085

BOEING AIRPLANE COMPANY

Fig. 3-108

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3-126

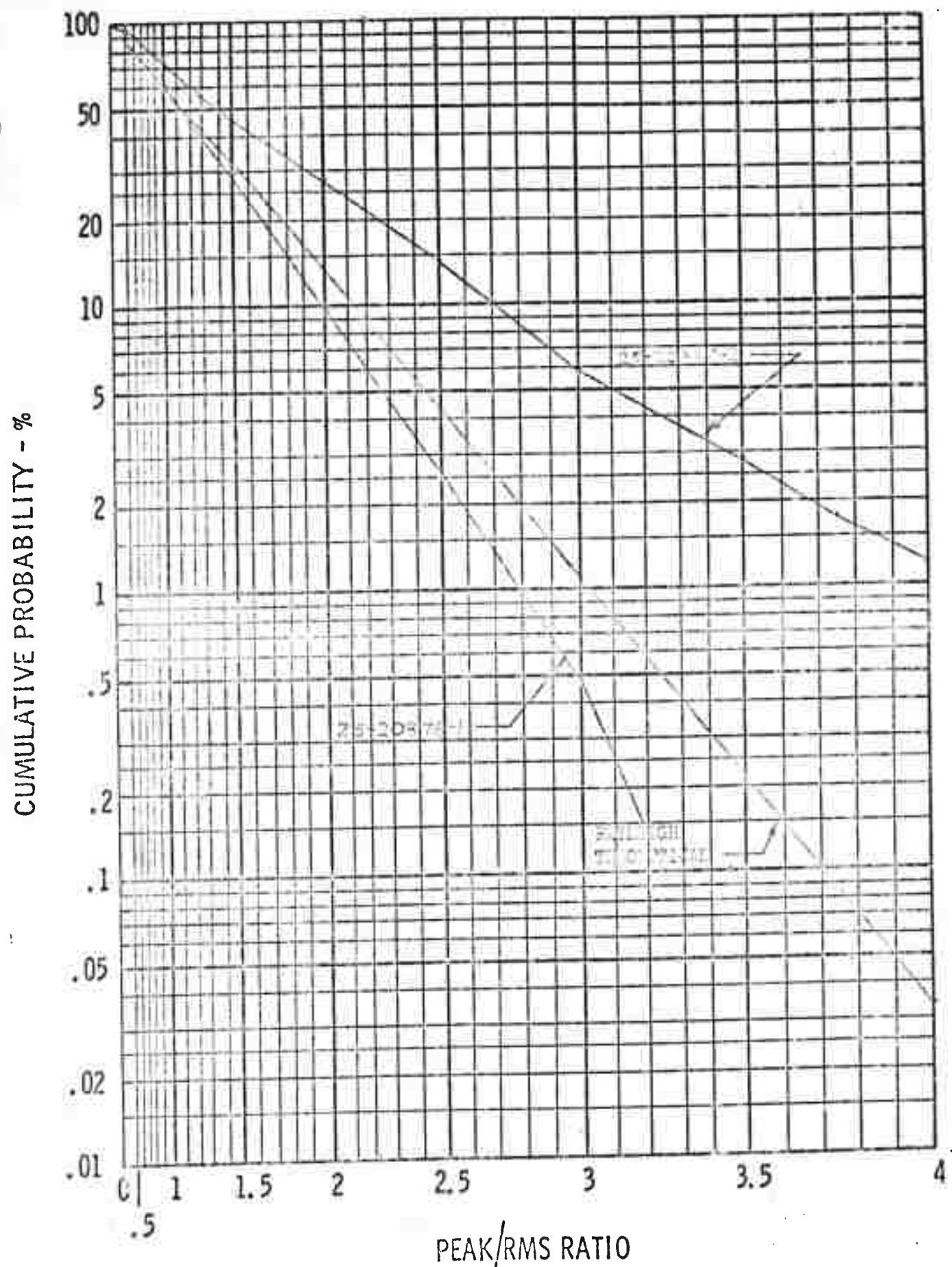
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| APPD  |  |  |         |      |
| APPD  |  |  |         |      |

X-RAY OF LEADING EDGE  
SPECIMEN 25-20376 AFTER TEST  
DS-1 LEADING EDGE LOAD TESTS

BOEING AIRPLANE COMPANY  
Fig. 3-109

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2-7000

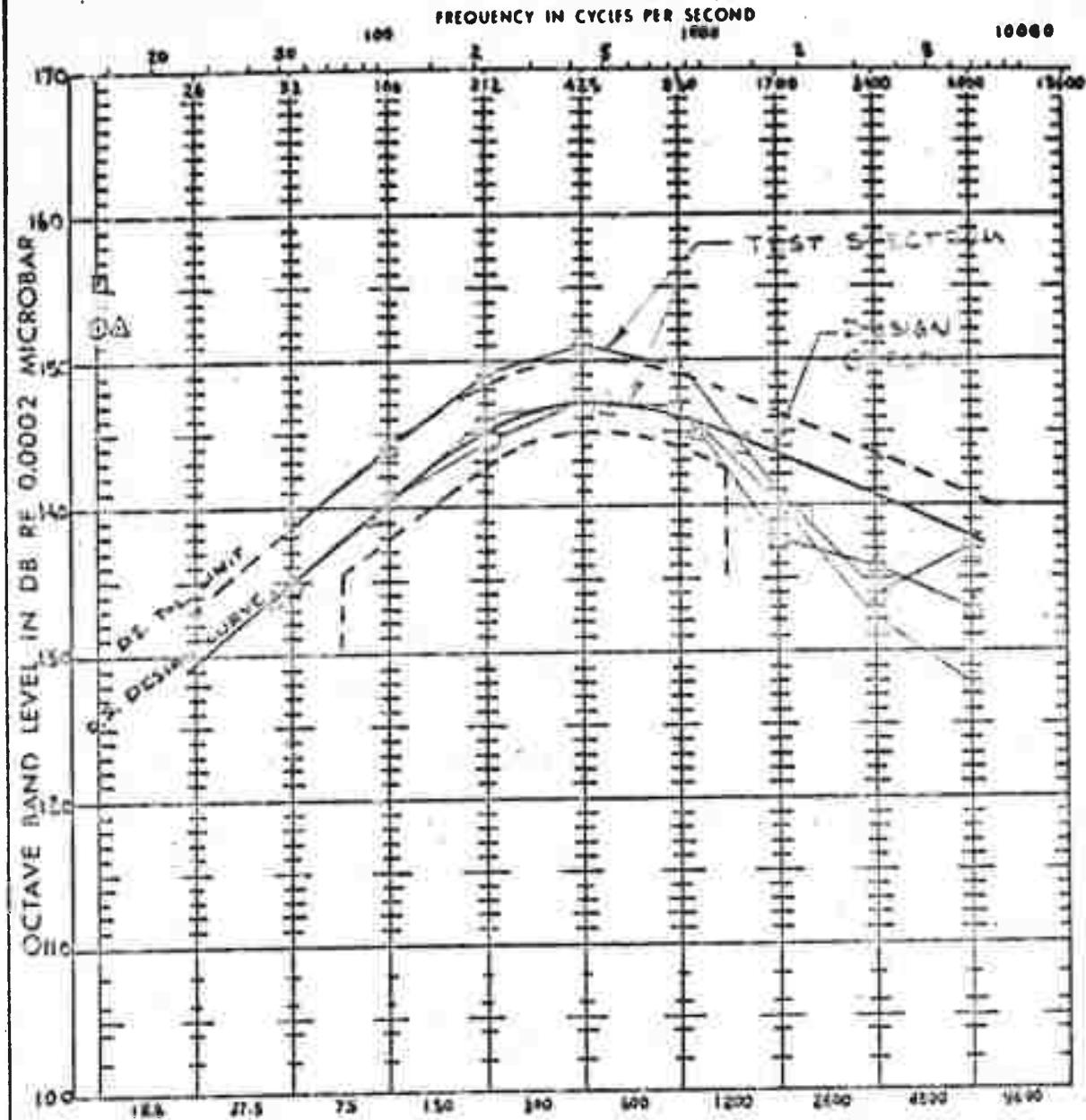


|  |         |         |      |                         |
|--|---------|---------|------|-------------------------|
| CALC   | 7/11/63 | REVISED | DATE | 22-30085                |
| CHECK  |         |         |      | Sect. 3                 |
| APPD   |         |         |      |                         |
| APPD   |         |         |      | PAGE 3-120<br>210-3-110 |
| AMPLITUDE DISTRIBUTION LIMITS FOR<br>ALL LEADING EDGE SPECIMENS TESTED |         |         |      |                         |
| BOEING AIRPLANE COMPANY  |         |         |      | 2-7000                  |

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E.WA



EQUILIZER SETTINGS

|             |        |
|-------------|--------|
| 20 - 75     | 33     |
| 75 - 150    | 19.5   |
| 150 - 300   | 17.0   |
| 300 - 600   | 10.0   |
| 600 - 1200  | 3.0    |
| 1200 - 2400 | -1.0   |
| 2400 - 4800 | 8      |
| 4800 - 9600 | 8      |
| O 3.6       | 40     |
| A 3.6       | 40     |
| C 4.0 AMPS  | 55 PSI |

2-5353-7-7

9-3-63

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CALC DH. for A.G. DATE 6/5/63  
NO. D2-80285

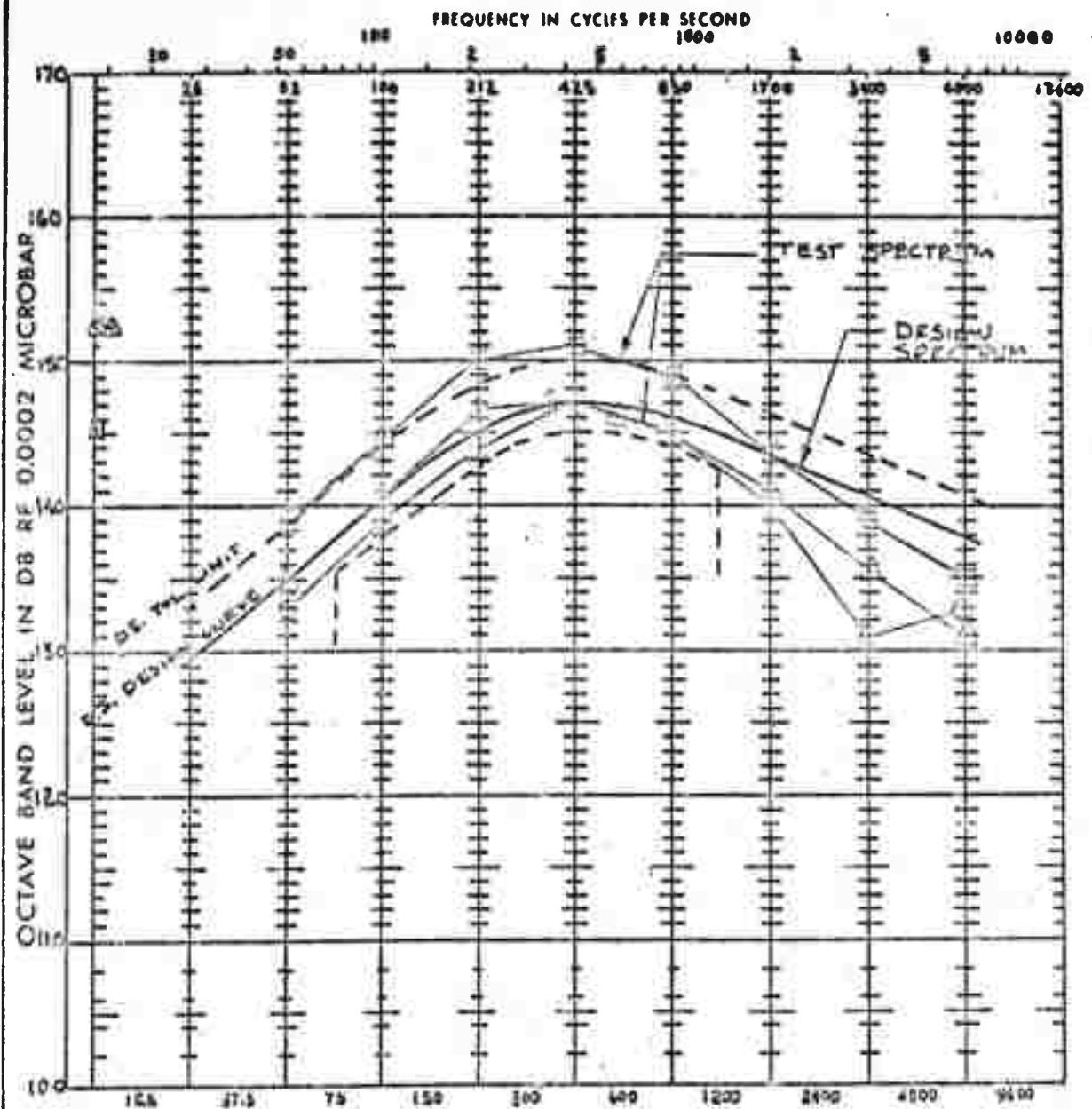
BOEING

SONIC LAB.

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Volume I Sect. 3

EWA



| OCTAVE PASS BANDS IN CYCLES PER SECOND |          |        |
|--|----------|--------|
| OVERALL                                | 0        | 40     |
| EQUALIZER SETTINGS                     | 0        | 40     |
| 20 - 75                                | 33       | 33     |
| 75 - 150                               | 19.5     | 24.0   |
| 150 - 300                              | 17       | 20     |
| 300 - 600                              | 10       | 11     |
| 600 - 1200                             | 3.5      | 3.8    |
| 1200 - 2400                            | -1.0     | -1.0   |
| 2400 - 4800                            | ∞        | ∞      |
| 4800 - 9600                            | ∞        | ∞      |
| 0                                      | 3.3      | 36     |
| △                                      | 4.0      | 36     |
| □                                      | 4.2 AMPS | 50 PSI |

MIC #1

25-20372-2

○ PHASE A

△ PHASE B

□ PHASE C

2-5353-7-7

9-3-63

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CALC DH FOR AB DATE 6/7/63

BOEING

NO. D2-80085

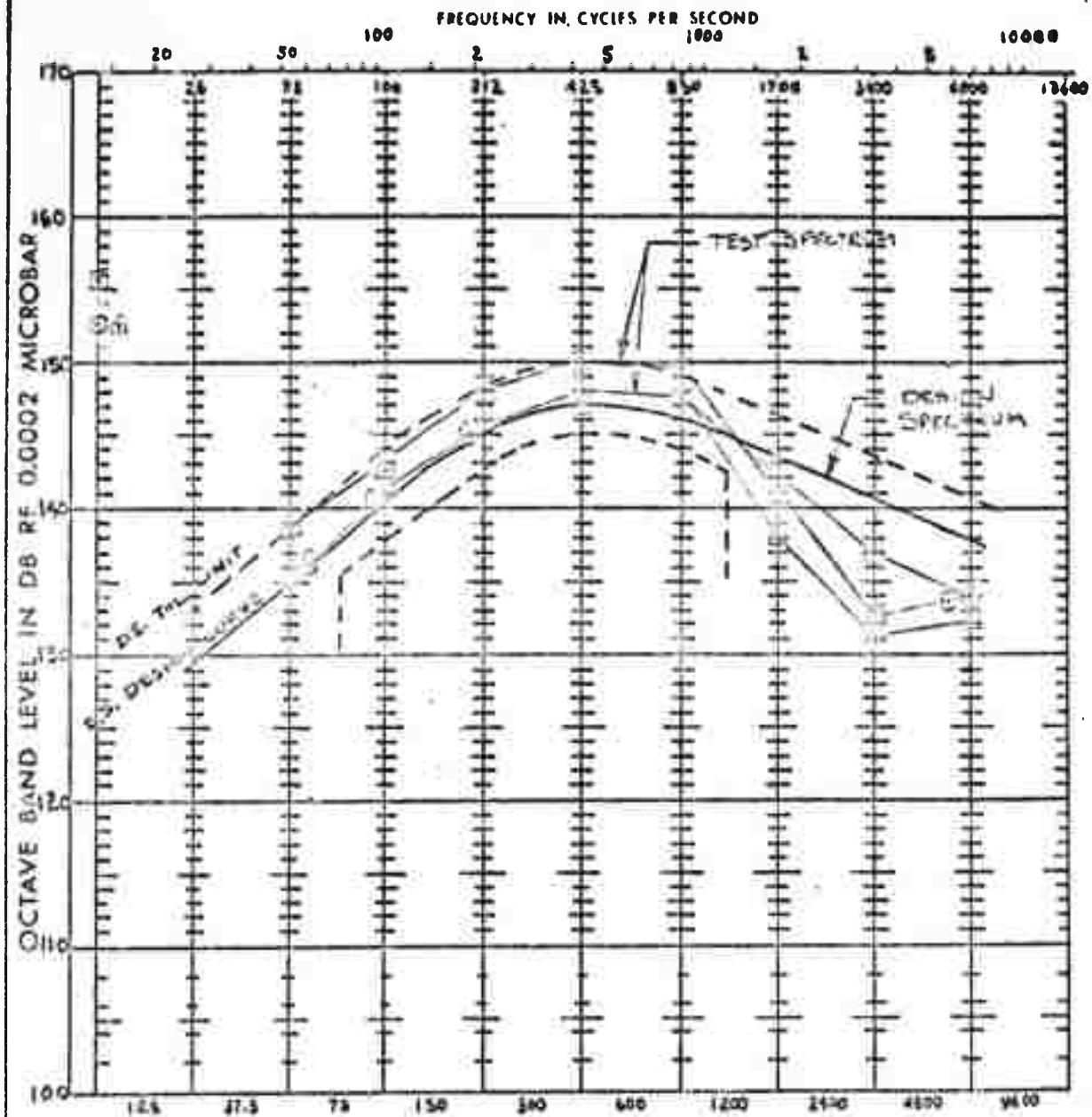
SONIC LAB.

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EWA



| OCTAVE PASS BANDS IN CYCLES PER SECOND |      |     |
|--|------|-----|
| OVERALL                                | 0    | △ □ |
| EQUILIZER SETTINGS                     |      |     |
| 20 - 75                                | 18.0 |     |
| 75 - 150                               | 15.5 |     |
| 150 - 300                              | 16.5 |     |
| 300 - 600                              | 10.0 |     |
| 600 - 1200                             | 3.5  |     |
| 1200 - 2400                            | -1.0 |     |
| 2400 - 4800                            | 00   |     |
| 4800 - 9600                            | 00   |     |
| 0 3.4                                  | 52   |     |
| △ -                                    | -    |     |
| □ - AMPS                               | -    | PSI |

MIC #1  
25-20367-1

○ PHASE A  
△ PHASE B  
□ PHASE C

2-5353-7-7

9-3-63

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CALC'D FOR AB DATE 6/7/63

BOEING

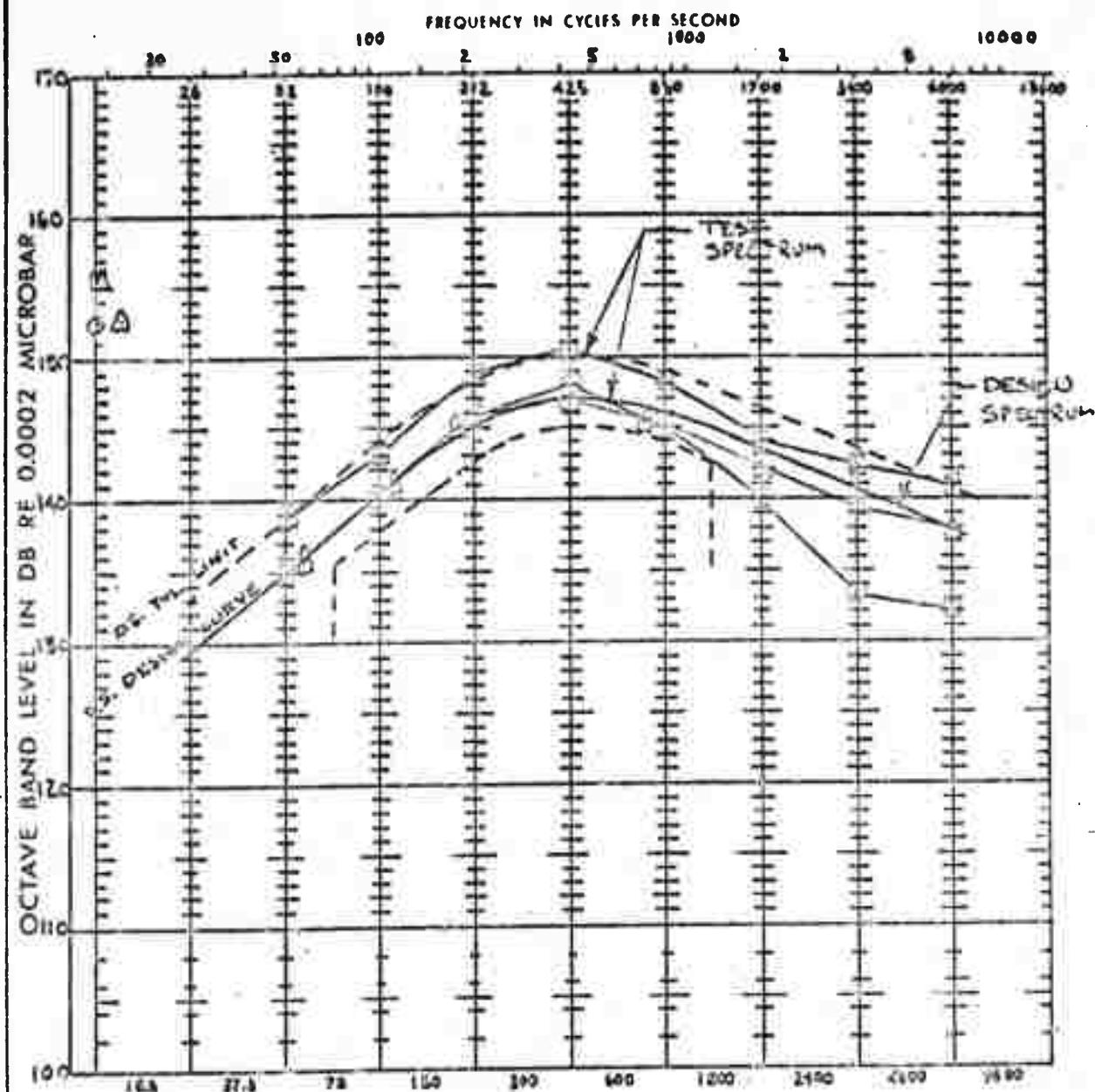
NO. 72-80085

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E.WA



| EQUILIZER SETTINGS | 0    | △   | □ |
|--------------------|------|-----|---|
|                    | ○    | △   | □ |
| 20 - 75            | 23   | 29  |   |
| 75 - 150           | 15.5 | 22  |   |
| 150 - 300          | 16.5 | 20  |   |
| 300 - 600          | 10   | 10  |   |
| 600 - 1200         | 7    | -1  |   |
| 1200 - 2400        | -1   | -1  |   |
| 2400 - 4800        | 00   | 00  |   |
| 4800 - 9600        | 00   | 00  |   |
| 0 3.2              | 40   |     |   |
| △ 4.0              | 50   |     |   |
| □ 4.0 AMPS         | 50   | PSI |   |

MIC #1  
25-20367-2

○ PHASE A

△ PHASE B

□ PHASE C

2-5353-7-7

9-3-63

CALC DH FOR AB DATE 6/7/63

BOEING

NO. D2-20085

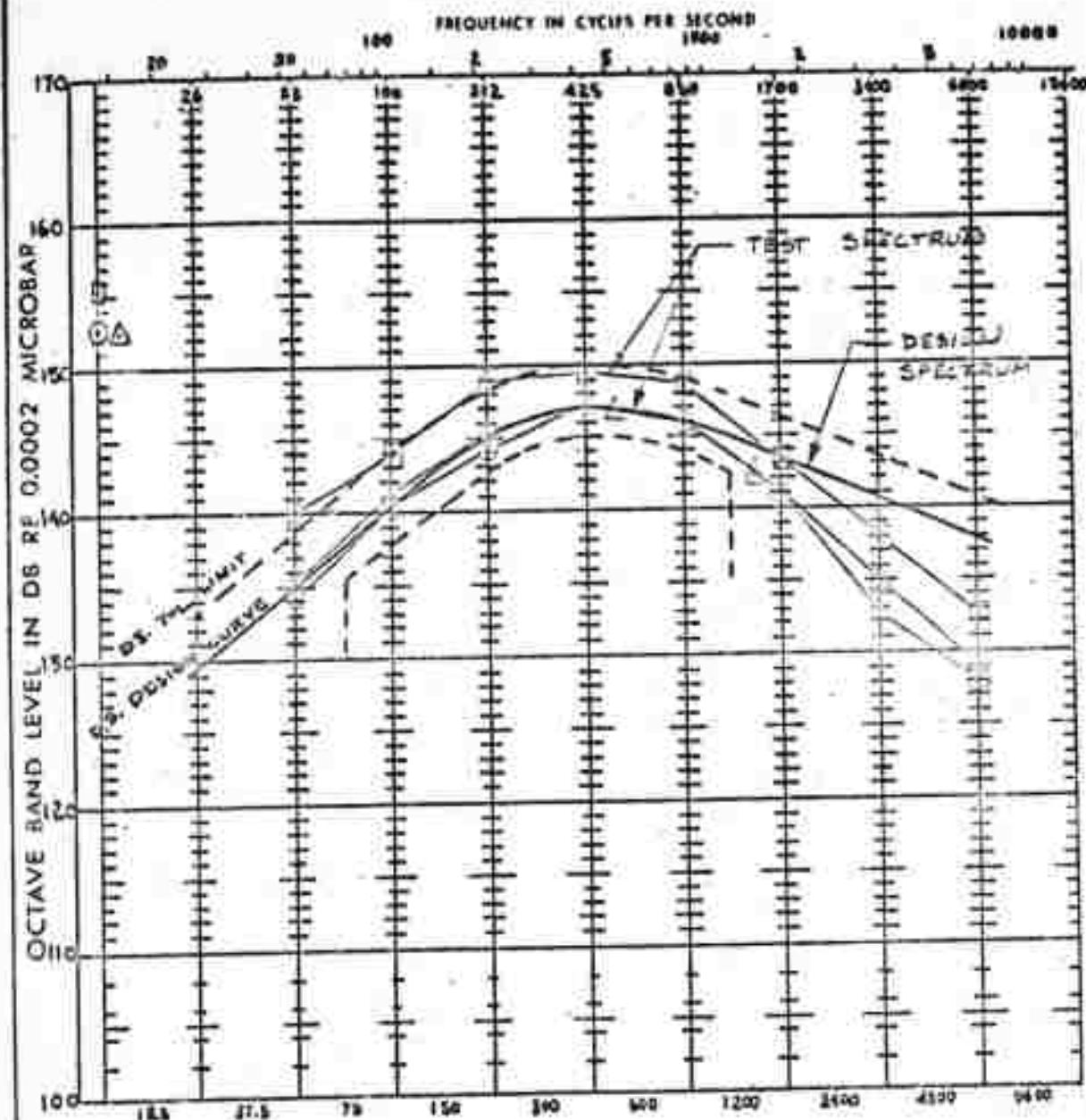
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EWA



OCTAVE PASS BANDS IN CYCLES PER SECOND  
MIC #1

25-20378-1

O PHASE A

△ PHASE B

□ PHASE C

2-5353-7-7

9-3-63

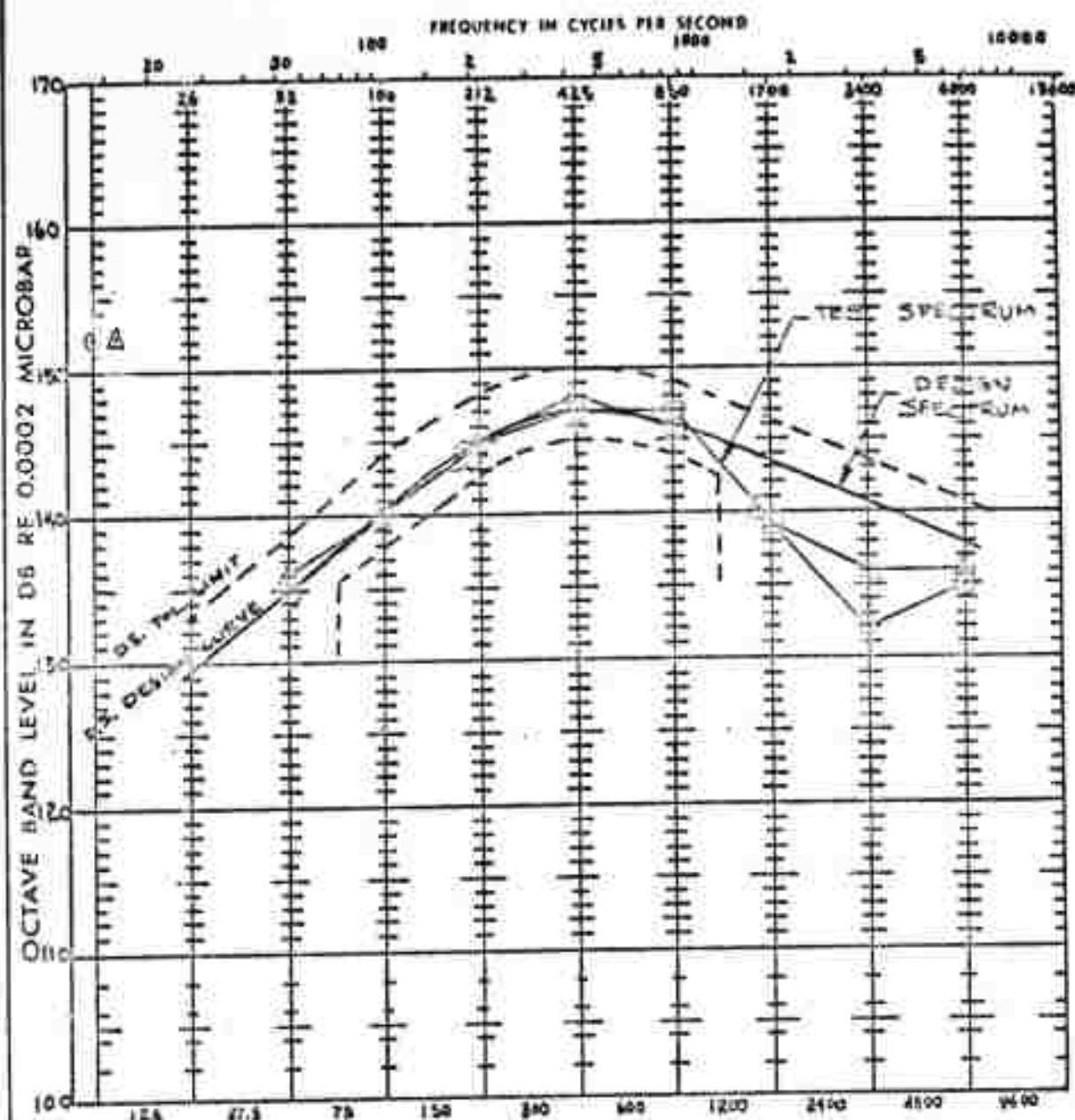
CALC DH FOR AB. DATE 6/5/63

NO. D2-90035

BOEING

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E.WA



| EQUILIZER SETTINGS |      |      |
|--------------------|------|------|
| 20 - 75            | 23   | 23.5 |
| 75 - 150           | 15.5 | 15.3 |
| 150 - 300          | 13   | 16.0 |
| 300 - 600          | 10   | 10.0 |
| 600 - 1200         | 3.5  | 4.5  |
| 1200 - 2400        | -1   | -1   |
| 2400 - 4800        | ∞    | ∞    |
| 4800 - 9600        | ∞    | ∞    |
| 0 2.5              | 60   |      |
| △ 3.1 AMPS         | 36   | PSI  |

MIC #1  
25-20378-2

○ PHASE A  
△ PHASE B

2-5353-7-7

9-3-63

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CALC'DN FOR AB DATE 6/7/63

BOEING

NO. D2-30085

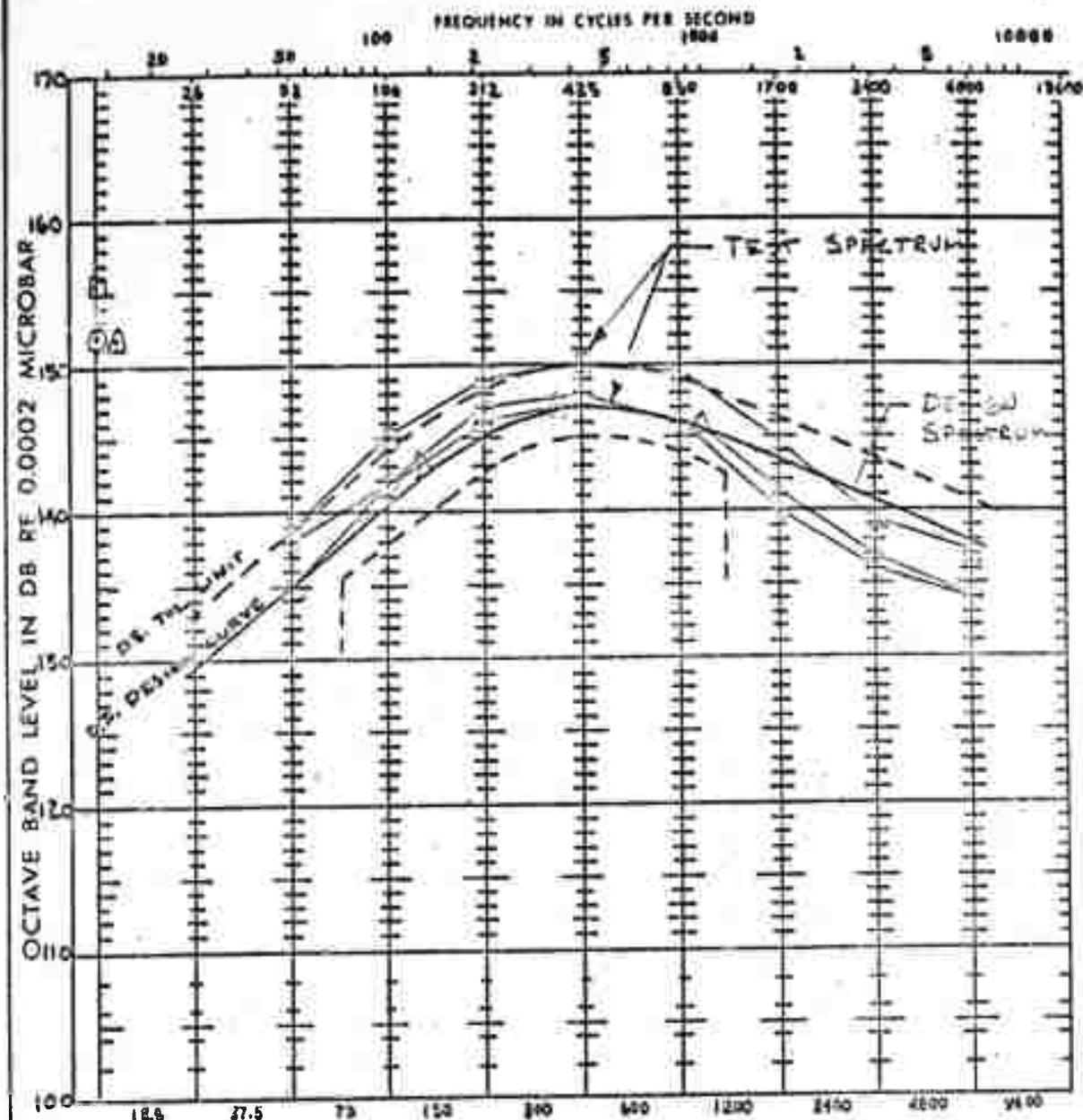
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EWA



| OCTAVE PASS BANDS IN CYCLES PER SECOND |      |      |
|--|------|------|
| 0                                      | △    | □    |
| <b>EQUILIZER SETTINGS</b>              |      |      |
| 20 - 75                                | 24.7 | 3.0  |
| 75 - 150                               | 15.5 | 15.5 |
| 150 - 300                              | 13.0 | 16.5 |
| 300 - 600                              | 10.3 | 12.5 |
| 600 - 1200                             | 2.7  | 7.0  |
| 1200 - 2400                            | -0.8 | -1.0 |
| 2400 - 4800                            | ∞    | ∞    |
| 4800 - 9600                            | ∞    | ∞    |
| 0 3.5                                  | 35   |      |
| △ 3.4                                  | 52   |      |
| □ 4.2 AMPS                             | 52   | PSI  |

MIC #1

25-20341-1

○ PHASE A

△ PHASE B

□ PHASE C

PER BANK OF 2 TRANSDUCERS  
(2 BANKS)

2-5353-7-7

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CALC DH FOR AB DATE 6/7/63

NO. DL-30085

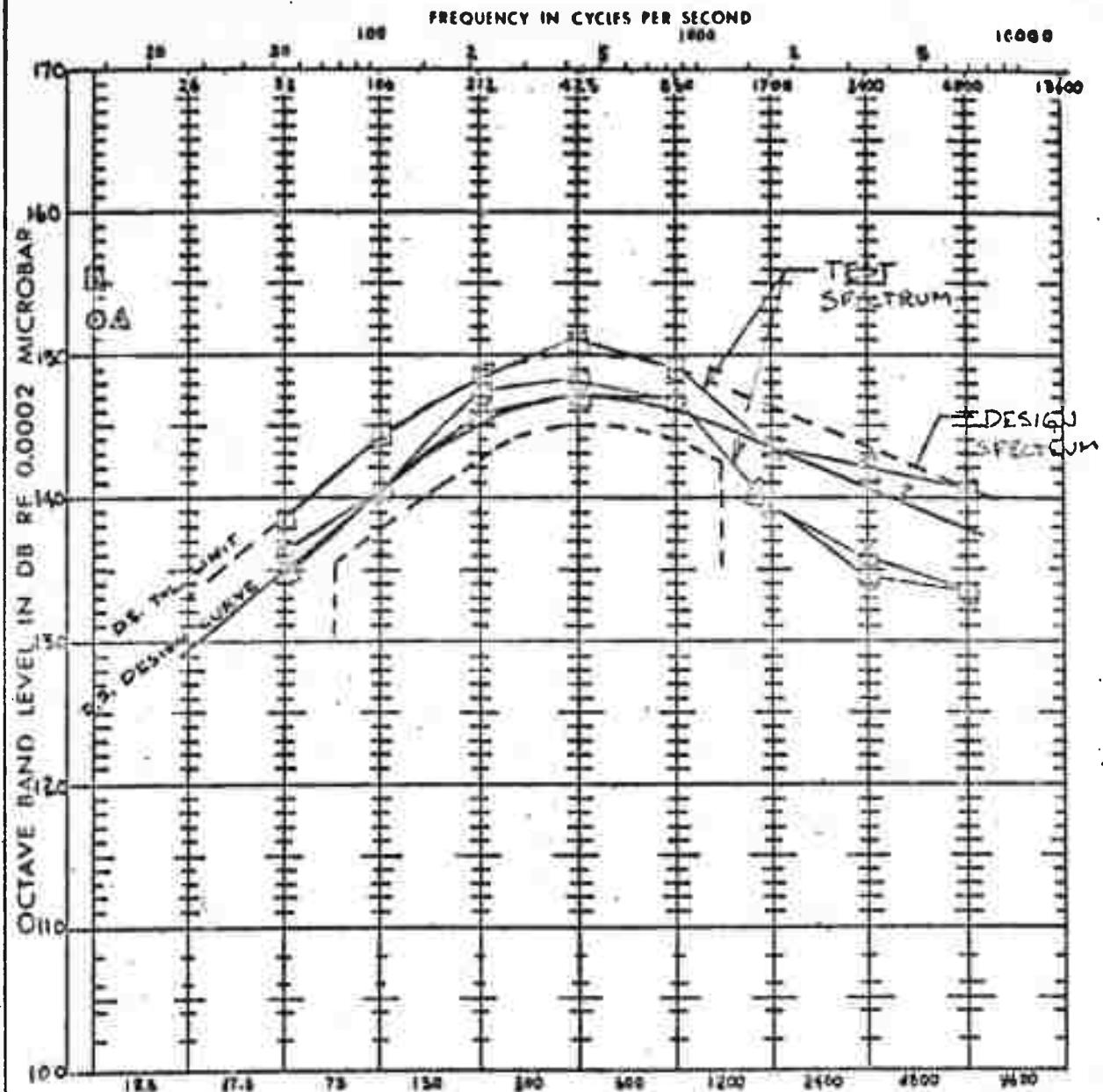
BOEING

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E.W.A



| EQUILIZER SETTINGS |    |     |      |
|--------------------|----|-----|------|
| 0                  | △  | □   | 0    |
| 20 - 75            | 19 | 24  | 33   |
| 75 - 150           | 13 | 16  | 20.2 |
| 150 - 300          | 13 | 13  | 23.5 |
| 300 - 600          | 10 | 10  | 10.0 |
| 600 - 1200         | 3  | 3   | -3   |
| 1200 - 2400        | -1 | -1  | .7   |
| 2400-4800          | 00 | 00  | 00   |
| 4800-9600          | 00 | 00  | 00   |
| 0 2.2              |    | 50  |      |
| △ 3.2              |    | 50  |      |
| □ AMPS             |    | PSI |      |

MIC #1

25-20341-2

O PHASE A

△ PHASE B

□ PHASE C

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CALC DH FOR AB DATE 6/7/63

BOEING

NO. D2-80085

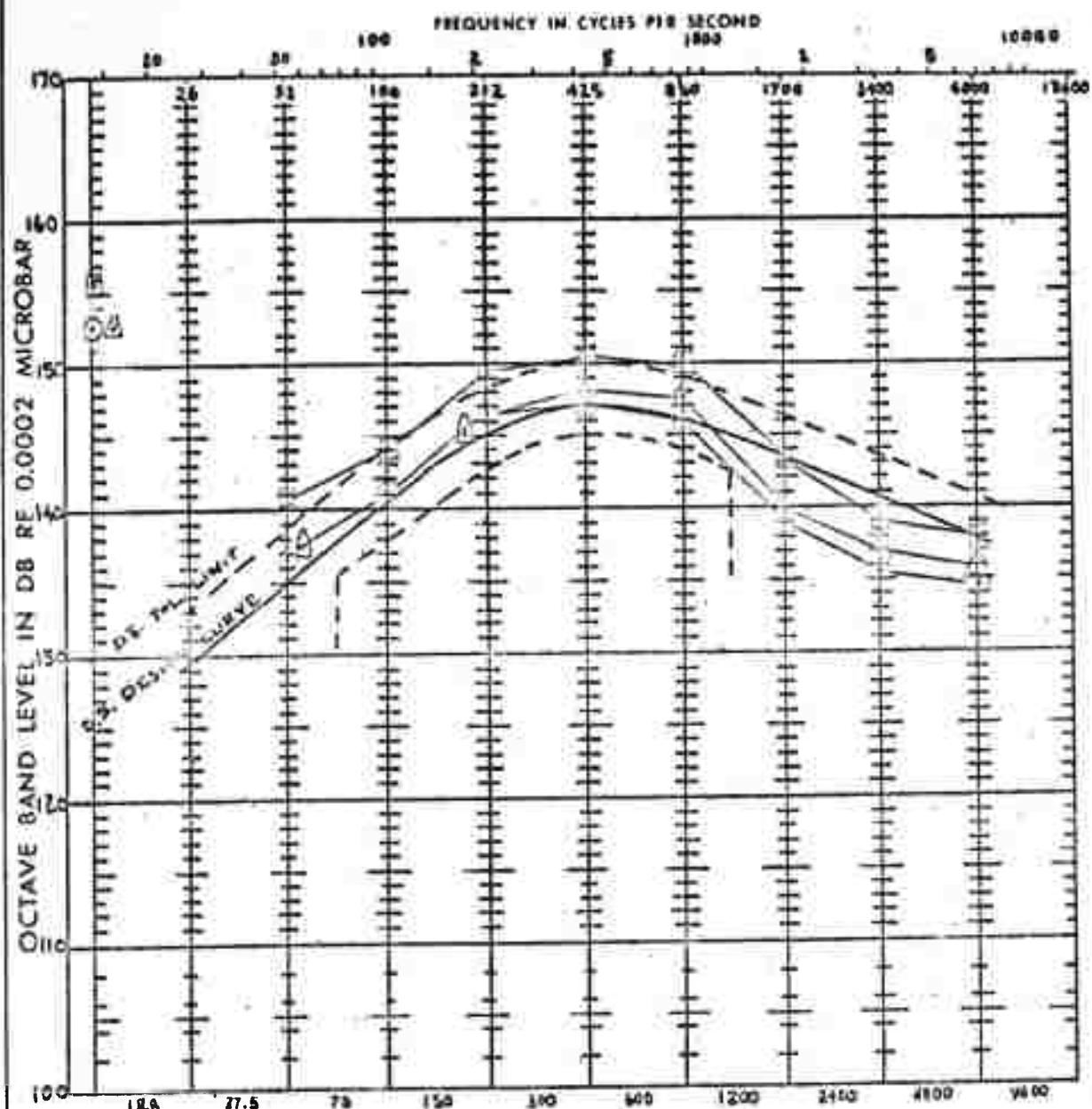
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E.WA



| OVERALL<br>EQUILIZER SETTINGS |      |      |
|-------------------------------|------|------|
| 0                             | 0Δ   | □    |
| 20 - 75                       | 23.0 | 23   |
| 75 - 150                      | 18.3 | 18   |
| 150 - 300                     | 13.0 | 10   |
| 300 - 600                     | 10.1 | 3    |
| 600 - 1200                    | 2.8  | -1.0 |
| 1200 - 2400                   | -1.0 | ∞    |
| 2400 - 4800                   | ∞    | ∞    |
| 4800 - 9600                   | ∞    | ∞    |
| 0 4.0                         | 50   |      |
| △ 4.0                         | 50   |      |
| □ 4.3 AMPS                    | 50   | PSI  |

MIC #1

20376-1

○ PHASE A

△ PHASE B

□ PHASE C

2-5353-7-7

9-3-63

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CALC DH FOR A.B. DATE 6/7/63

BOEING

NO. D2-30085

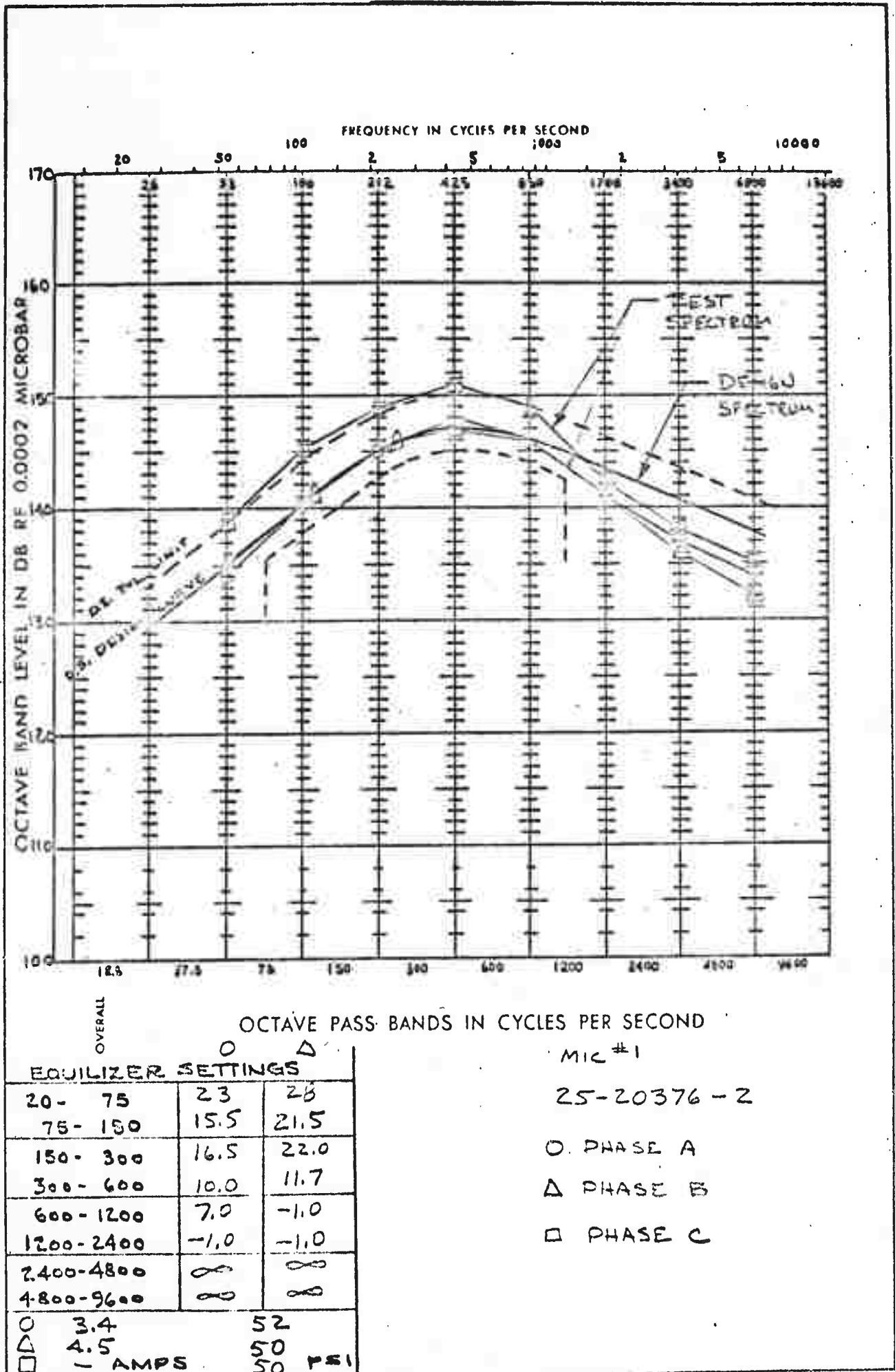
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CALC'DN FOR AB DATE 6/7/63

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→

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